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The new Australian leaf-curling orb-weaving spider genus *Leviana* (Araneae, Araneidae)

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Abstract

The new Australian orb-weaving spider genus *Leviana* **gen. nov.** is described to include five species, all known from both sexes: *Leviana dimidiata* (L. Koch, 1871) **comb. nov.** (type species) (= *Epeira sylvicola* Rainbow, 1897 **syn. nov.**), *L. cincinnata* **sp. nov.**, *L. folium* **sp. nov.**, *L. minima* **sp. nov.** and *L. mulieraria* (Keyserling, 1887) **comb. nov.** Male pedipalp morphology, specifically the presence of a single patella spine and the median apophysis forming an arch over the radix, place *Leviana* **gen. nov.** in the informal Australian 'backobourkiine' clade; however, the genus differs from all other genera of this group by the presence of a spine inside the basal median apophysis arch of the male pedipalp, an epigyne that is wider than long with a scape that is approximately as long as the epigyne (but often broken off) and a lack of humeral humps on the elongate ovoid abdomen. In addition, unlike any other backobourkiine, *Leviana* **gen. nov.** incorporate a rolled leaf as retreat into the periphery of their web. *Leviana* **gen. nov.** species exhibit only a moderate sexual size dimorphism with female to male ratios between 1.3 and 1.7. *Leviana* **gen. nov.** occurs in eastern Australia from northern Queensland in the north to Victoria in the south, with a single tropical species, *L. mulieraria* **comb. nov.**, spreading into northern Western Australia.

Key Words

Taxonomy, systematics, backobourkiines, new genus, leaf retreat

Introduction

Recent comprehensive phylogenetic studies on the orb-weaving spiders in the family Araneidae Clerck, 1757 have transformed our understanding of the systematic relationships within this family (Kallal et al. 2018; Kuntner et al. 2019; Scharff et al. 2020), although the limitations of the Araneidae itself remain contentious (Kallal et al. 2020). This is in part due to the unresolved family taxonomy at the base of "araneids", i.e. the families Araneidae s.s., Nephilidae Simon, 1894 and Phonognathidae Simon, 1894 (*sensu* Kuntner et al. 2019) vs a larger, older, and undiagnosed Araneidae s.l. *sensu* Scharff et al. (2020) and Kallal et al. (2020). More relevant to the systematic issue within this paper, and more distal in the araneid phylogeny, the traditional subfamily Araneinae Clerk, 1757 (*sensu* Scharff and Coddington 1997) is now understood to be seriously paraphyletic. With respect to the Australian fauna, the groups previously thought as araneines fall into two major groups: the 'backobourkiines' with

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some affinities to the Nearctic 'eriophorines' (but apparently more closely related to the morphologically more derived 'gasteracanthines'), and the 'zealaraneines' with closer phylogenetic affinities to traditional araneine genera, including *Araneus* Clerck, 1757 itself (Scharff et al. 2020). The Australian backobourkiines are the subject of an ongoing, comprehensive project with the aim to taxonomically revise all its constituent Australian genera and to formalize the subfamily once it can be diagnosed (e.g., Framenau et al. 2010, 2021a, b, 2022; Framenau 2011).

Two morphological characters of the male pedipalp have been hypothesised as synapomorphies of the backobourkiines, i.e., the presence of a single patellar spine (e.g. two in the 'eriophorines' or 'zealaraneines') and the base of the median apophysis forming an arch over the radix (Scharff et al. 2020). These characters are also present in *Araneus dimidiatus* (L. Koch, 1871), an Australian species that did not group with the backobourkiines in Scharff et al.'s (2020) analysis, but formed a clade with *Dolophones* Walckenaer, 1837 and *Cyclosa* Menge, 1866, albeit with no statistical support. An earlier transcriptomic analysis also suggested affinities of *A. dimidiatus* with the backobourkiines, either as sister to *Hortophora transmarina* (Keyserling, 1865), or sister to *H. transmarina* and *Plebs eburnus* (Keyserling, 1886) combined, but those analyses included fewer putative backobourkiine taxa (Kallal et al. 2018).

Araneus dimidiatus was described as *Epeira dimidiata* Koch, 1871 from female material collected in Port MacKay, Queensland. An apparently similar species, *Araneus sylvicola* (Rainbow, 1897) was subsequently described as *Epeira sylvicola* Rainbow 1897 based on a female collected in Guildford, New South Wales. Rainbow (1897) detailed the web-building and prey-capture behaviour of this species (pg. 539): "*Speaking generally, the Epeiridae do not all construct tube-nests or retreats. Among those that do so*, Epeira wagneri [now a junior synonym of *Phonognatha graeffei* (Keyserling, 1865)] *and* E. sylvicola *are never seen resting at the centre or "hub", as is the usual custom with orb-weavers; on the contrary, they are always to be found within their rolled-leaf nests. Whenever an insect becomes entrapped within the mesh, these spiders immediately rush out and enswathe the struggling victim in the usual manner of the Epeiridae*." Indeed, the somatic morphology of *A. dimidiatus*, specifically the ovoid, cylindrical abdomen lacking any humps or processes (e.g., Figs 1C, 6A, 7A), caused many misidentifications in collections as *Phonognatha* Simon, 1895, a member of the Phonognathidae *sensu* Kuntner et al. (2019), or "Zygiellinae" Wunderlich, 2004 (Kallal and Hormiga 2018) – a junior synonym of Phonognathinae. There are clear differences among the web architecture between *Phonognatha* and *A. dimidiatus*, however. *Phonognatha* has architectural elements of the web that are known in phonognathids and nephilids and not araneids, such as late radii and temporary spiral in the complete web, which *A. dimidiatus* lacks, and furthermnore, the leaf retreat of *Phonognatha* opens at the hub (Kuntner et al. 2008), whereas the leaf retreat of *A. dimidiatus* is placed and opens at the periphery of the orb (e.g. at its upper frame, see Fig. 1). These differences hint at convergently evolved leaf retreat solutions in these taxa.

Genital morphology of *A. dimidiatus* is typical backobourkiine. Comprehensive investigation of the type material and araneids from Australian museum collections revealed that *A. dimidiatus* and *A. sylvicola* are the same species and that *Araneus mulierarius* (Keyserling, 1887) is morphologically closely aligned. In addition, we found three further undescribed araneids in Australian collections apparently closely related to these species. The aim of this study is to revise all Australian species morphologically related to *A. dimidiatus* in a new genus as testable hypothesis for future systematic work, specifically to elucidate phylogenetic relationships of the new genus to or within the backobourkiines.

Materials and methods

Taxonomy

Descriptions and terminology follow recent publications on backobourkiine orb-weaving spiders (e.g. Framenau et al. 2021a, b, 2022). Colour patterns were described based on specimens preserved in ca. 75% EtOH. Redescriptions of historically named species are based on recently collected, well-preserved, material in lieu of often damaged and discoloured type specimens.

To evaluate critical sclerites, a male pedipalp of *A. dimidiatus* was detached and expanded by alternatively submerging it for 10 min in 10% KOH and distilled water until fully expanded (Fig. 5A–C). Sclerite nomenclature follows that in previous studies on backobourkiines, e.g. the use of 'conductor lobe' in lieu of 'paramedian apophysis' (e.g. Framenau et al. 2021a; Framenau et al. 2021b) and terminal apophysis for a prominent distal part of the embolic division (Framenau et al. 2022). The description of the views of the male pedipalp relate to their position as a limb, taking into consideration the araneid twist, i.e. the cymbium is situated mesally. We therefore consider our standard views of the left pedipalp ventral (i.e. with the cymbium to the left of the image) – to particularly illustrate the generally diagnostic median apophysis – or dorsal (i.e. with the cymbium to the right of the image) – with the subtegulum and tegulum in full view.

The two main parts of the female epigyne are referred to as base (encapsulating the internal genitalia) and the scape. We refer to the central part of the base in ventral view as atrium which, in posterior view, becomes the central division. We removed and cleared selected epigynes to illustrate internal genitalia by submerging them in warm, 10% KOH for approximately 20 min. For observation and imaging, they were transferred into lactic acid on a microscopic glass slide under a coverglass which further cleared internal structures (Fig. 6A, B).

Microscopic images were taken in different focal planes (ca. 20–30 images) on a Leica DMC4500 digital

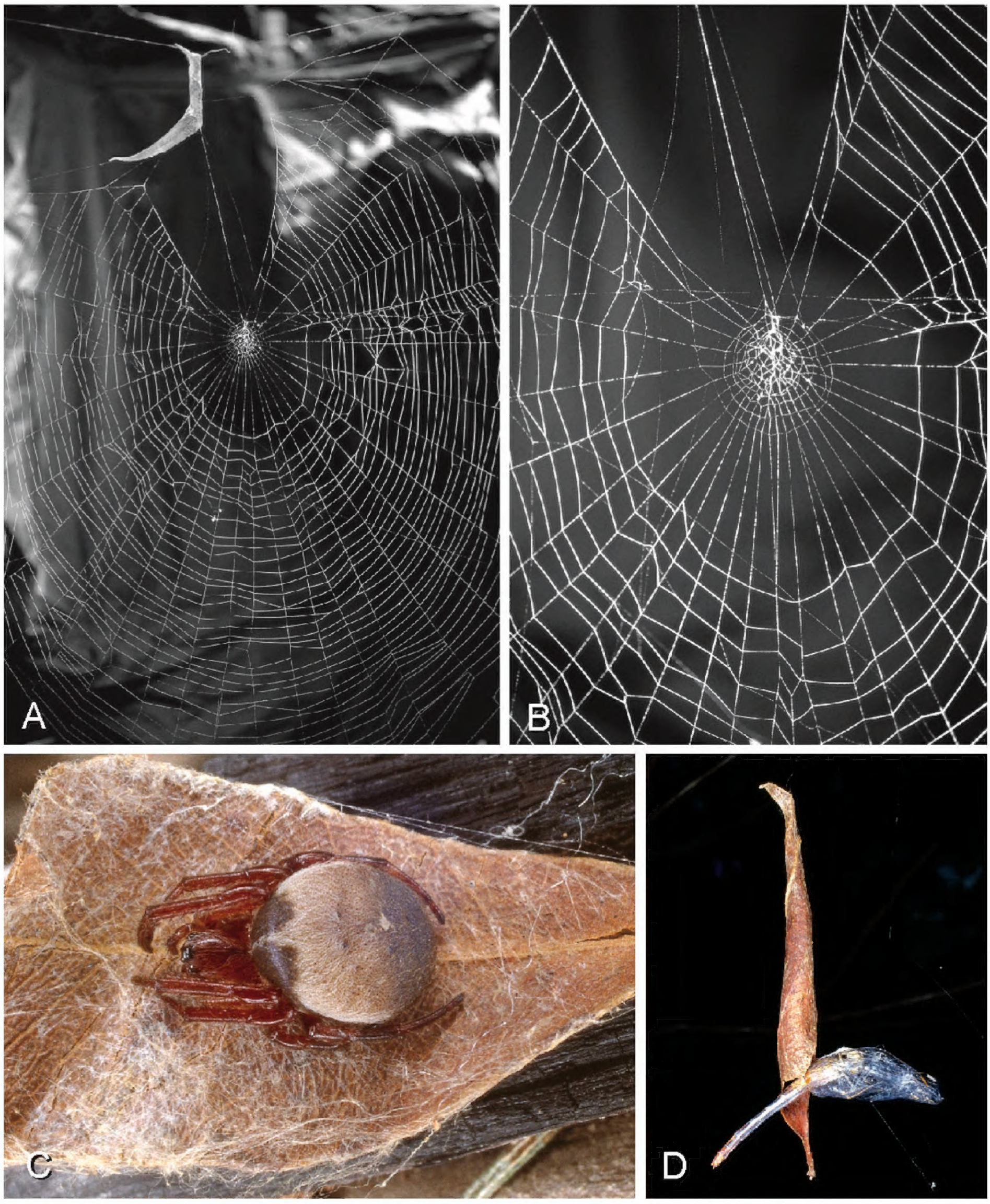


Figure 1. *Leviana dimidiata* comb. nov. natural history (at Whites Hill, Queensland): **A.** Female vertical orb-web with spider in curled leaf retreat connected with hub via signal line; **B.** Same web, close up; note V-shaped open sector with signal line, closed hub with abrupt transition between hub loops and sticky spiral, and all radii originating at hub; **C.** Female in defensive pose after her leaf-retreat had been torn open; **D.** Leaf retreat with female (not seen) feeding on dragonfly prey.

camera mounted to a Leica M205C stereomicroscope and combined using the Leica Application Suite X, v. 3.6.0.20104. All photos were edited with Photoshop CC 2020 and combined into plates with Microsoft PowerPoint. Specimens were prepared for SEM imaging (Figs 2A–D, 3A–F) by passing morphological preparations through graded ethanol series of 70% to 100%, and by subsequent critical point drying in a Baltec CPC-030 Critical Point Dryer. Specimens were then coated with Platinum-Palladium in a JEOL JFC-2300HR high resolution coater prior to scanning at 7kV in a JEOL JSM-6335F Field Emission Electron Microscope.

All measurements are taken from adults and are given in millimeters. They were taken with an accuracy of one tenths of a millimetre, with the exception of eye and labium measurements taken with an accuracy of one hundredth of a millimetre.

Maps were compiled in the software package QGis v. 3.22.3 Białowieża (https://qgis.org/en/site/; accessed 11 February 2022). Geographic coordinates were extracted directly from original labels or the registration data as provided by the museums. When no detailed geographic information was available, localities were estimated to the closest minute based on Google Earth Pro v. 7.3.4.8248 (https://earth.google.com/web/; accessed 11 February 2022).

The taxonomic part of this study lists all species in alphabetical order, except for the type species of the new genus, which is treated first.

Web architecture

Leviana dimidiata comb. nov. web-building behaviour was studied on 6 April 2002 at Whites Hill, Brisbane (Queensland). More than 10 females were found and collected from their web retreats. Webs were photographed after being dusted with corn starch (Eberhard 1976; Carico 1977). The nomenclature of web architecture (e.g. Blackledge et al. 2011) derives from treatments of phonognathid (Kallal and Hormiga 2018), tetragnathid (Hormiga et al. 1995; Kuntner et al. 2008), araneid (Scharff and Coddington 1997) and nephilid spiders (Kuntner 2005; 2006; 2007; Kuntner et al. 2008). Non-digital images were scanned for digital enhancement and manipulation in Adobe Photoshop 7.0 and Adobe Illustrator 10.

Abbreviations

Morphology

ALE, AME anterior lateral (median) eyes
PLE, PME posterior lateral (median) eyes

Collections

AM Australian Museum, Sydney (Australia)
MV Museum Victoria, Melbourne (Australia)
NHMD Natural History Museum of Denmark, Zoological Museum, University of Copenhagen, Denmark
NHMUK Natural History Museum, London (England)
QM Queensland Museum, Brisbane (Australia)
SAM South Australian Museum, Adelaide (Australia)
WAM Western Australian Museum, Perth (Australia)
ZMH Zoologisches Institut und Zoologisches Museum, Universität Hamburg, Germany

Results

The new genus *Leviana* gen. nov. is reasonably common in its distribution range; a total of 218 males, 717 females, and 227 juveniles in 426 records (= vials) were examined for this study (Table 1). Based on standard diagnostics, we recognise five species, three of which are new to science (Table 1). *Leviana* gen. nov. mostly inhabits eastern Australia, although the tropical *L. mulieraria* comb. nov. is also found in northern Western Australia (Table 1). *Leviana* gen. nov. has so far not been found in Tasmania.

Web architecture and natural history

Females of *L. dimidiata* comb. nov. construct two-dimensional, vertical aerial orb webs with a V-shaped open sector among low vegetation (Fig. 1A, B). The web always has the addition of a dry rolled leaf as retreat (Fig. 1A, D). The retreat is positioned at the top frame within the V-shaped open sector of the orb (Fig. 1A). Typically, the leaf is sealed on top, thus the retreat has a single opening in the lower part (Fig. 1 D). A signal line connects the retreat with the hub. The hub, which is located centrally within a circular orbweb, is closed, with regularly spaced hub loops followed by a gap, a so-called abrupt transition to the catching spiral (Kuntner et al. 2008). Unlike the webs of an unrelated, but approximately co-distributed species *Phonognatha graeffei*, *Leviana* gen. nov. webs contain no late radii, meaning that all radii originate at the hub.

Juveniles and females remain in their retreats during the day. No males were found in female webs despite careful searching in the retreats. A female was observed feeding, from her retreat, on a large libellulid dragonfly, but no other prey types are known. No predators of *Leviana* gen. nov. are currently known, but their webs were occupied by theridiid symbionts.

Table 1. Distribution and summary of material examined of the species of *Leviana* gen. nov. in Australia. Abbreviations: NSW – New South Wales, NT – Northern Territory, Qld – Queensland, Vic – Victoria, WA – Western Australia.

Species	Type locality	Distribution	Comments	Material examined
L. dimidiata (L. Koch, 1871) comb. nov.	McKay (Qld)	Qld, NSW, Vic	Type species of *Leviana* gen. nov.	50 males, 321 females, 33 juv.
L. cincinnata sp. nov.	Bellenden Ker Range (Qld)	Qld		30 males, 46 females, 37 juv.
L. folium sp. nov.	Kroombit Tops (Qld)	Qld, NSW		43 males, 99 females, 5 juv.
L. minima sp. nov.	Thornton Peak (Qld)	Qld		89 males, 235 females, 141 juv.
L. mulieraria (Keyserling, 1887) comb. nov.	Cape York (Qld)	Qld, NT, WA		6 males, 16 females, 11 juv.

Taxonomy

Class Arachnida Cuvier, 1812
Order Araneae Clerck, 1757
Family Araneidae Clerck, 1757

***Leviana* gen. nov.**
https://zoobank.org/4DA6D7EB-7B17-478A-BB2D-6B57EDBD7806

Type species. *Epeira dimidiata* L. Koch, 1871 (designated here).

Etymology. The generic name honours the late Herbert Levi (1921–2014) for his contribution to araneid taxonomy and systematics. The gender of the genus-group name is feminine.

Diagnosis. The following morphological and behavioural synapomorphies unequivocally diagnose *Leviana* gen. nov. from other genera of the Araneidae, specifically those of the putative backobourkiines (*Acroaspis* Karsch, 1878; *Backobourkia* Framenau, Dupérré, Blackledge & Vink, 2010; *Carepalxis* L. Koch, 1872, *Hortophora* Framenau & Castanheira, 2021; *Lariniophora* Framenau, 2011; *Novakiella* Court & Foster, 1993; *Plebs* Joseph & Framenau, 2012; *Salsa* Framenau & Castanheira, 2022, *Socca* Framenau, Castanheira & Vink, 2022): abdomen without humeral or posterior dorsal humps; basal arch of the median apophysis of the male pedipalp internally with basally directed spine (e.g. Figs 3C, 4A, 7C, 12C, 15C); female epigyne generally wider than long, ovoid atrium, scape broad to triangular without terminal pocket, but broken off in most specimens (e.g. Figs 3E, 8C, 11C, 16C, D); incorporation of a curled leaf as retreat into the periphery of an open V-section in the web (Fig. 1A) (but details on web-building in some species unknown).

Members of the genus *Leviana* gen. nov. superficially resemble those of the leaf-curling genera *Artifex* Kallal & Hormiga, 2018, *Deliochus* Simon, 1894 and *Phonognatha*, particularly in the cylindrical shape of the abdomen and the lack of abdominal humps. However, this is likely a reflection of the leaf-curling behaviour which appears to favour such body shape. *Artifex*, *Deliochus* and *Phonognatha* belong to the araneid subfamily Phonognathinae (as Zygiellinae in Kallal and Hormiga (2018)) or Phonognathidae (*sensu* Kuntner et al. 2019), whereas *Leviana* gen. nov. morphology is consistent with the backobourkiines (*sensu* Scharff et al. 2020).

Description. Small to medium-sized (total length males ca. 2.0–7.0, females 2.5–10.0 mm) orb-weaving spiders, with males slightly smaller than females. This difference in the size of sexes can be considered as very moderate sexual size dimorphism (Kuntner and Coddington 2020). ***Carapace*** (e.g. Figs 7A, 8A, 10A, 11A, 17A, 18A) longer than wide, pear-shaped; centre of cephalic region protruding more in males than in females; fovea poorly demarcated both in males and females forming a shallow pit; colouration brown in variable shades, sometimes with darker lateral flanks and cephalic area generally lighter; weak white pubescence both in males and females, particularly in the cephalic area. ***Eyes*:** anterior median eyes largest, their row wider than that of posterior median eyes; row of posterior eyes slightly recurved; lateral eyes almost touching and separated by more than their diameter from posterior median eyes; lateral eye groups elevated, a small horn of this elevation protrudes anteriorly. ***Sternum*** longer than wide. ***Labium*** wider than long, subtriangular, front end bulging and white. ***Maxillae*** with large lateral tooth present in males. Chelicerae with 4 (rarely 3) promarginal teeth, 3 (rarely 2) retromarginal teeth, ***Legs*:** leg formula I > II > IV > III; tibiae I and II in males strong in some species with more distinct spines, specifically prolaterally (e.g. Figs 12A, B, 15A, B, 17A, B); coxae I of male with hook and femora II with opposing groove. ***Abdomen*** longer than wide; ovoid to cylindrical, slightly dorsoventrally flattened in some species (e.g., Figs 7A, 8A, 12A, 13A, 17A, 18A); booklung covers with grooves; dorsum of abdomen uniform with some dark or light markings (Figs 7A, 8A, 10A, 11A) or with more or less distinct folium pattern (e.g., Figs 12A, 13A, 15A, 16A); ventral abdomen centrally light to dark grey, generally with lateral irregular guanine bands (e.g., Figs 8B, 10B, 13B, 18B).

Spinnerets (based on female *L. folium* sp. nov. see Fig. 2A–D) (nomenclature and abbreviations after Coddington (1989)): Anterior lateral spinnerets (ALS) with large field of piriform gland spigots (PI) (piriform spigots with normal bases), a major ampullate gland spigot (MAP) and a nubbin (nu) (Fig. 2B); posterior lateral spinnerets (PLS) with large field of aciniform gland spigots (AC), two aggregate gland spigots (AG) with a flagelliform gland spigot (FL) in between and a cylindriform gland spigot (CY) mesally (Fig. 2C); posterior median spinneret with large field of aciniform gland spigots, a central cylindriform gland spigot and a posterior minor ampullate gland spigot (mAP) (Fig. 2D).

Male pedipalp femora with tubercle; patellae with a single strong macroseta (e.g., Fig. 4A, 5B, 7C, D). Paracymbium present, simple and rounded (Figs 4B, 5C, 7D). Cymbium narrow. Conductor entire and prominent, heavily sclerotised, with a number of lobes and processes (e.g. Figs 3A, 4A, 5B); basal conductor lobe present (e.g. Figs 3A, 4A, 5B). Median apophysis transverse, tip pointing apically and either broadly lobed (Figs 3A, 4A, 5B, 7C, 10C, 12C) or more or less tapering (Figs 15C, 17C), basal arch internally with large spine (Figs 3A, C, 4A, 7C, 12C). Embolic division with radix, stipes, terminal apophysis and embolus (e.g., Figs 3A, B, 5A–C). Radix elongated, partially sclerotised. Stipes a thin, sometimes translucent but prominent lamella (e.g. Figs 3A, D, 4A, 5A, 7A). Terminal apophysis fleshy, elongated and terminating in two lobes or one lobe and spine (Figs 3A, D, 4A, B, 17C). Embolus short, curved and heavily sclerotised (e.g. Fig. 3A, D); tip of the embolus uncapped.

Epigyne ovoid, generally wider than long (e.g. Figs 3E, F, 8C, F, 11C, F), scape approximately as long as epigyne, thin, broadly lipped or triangular (Figs 8C, 11C, 13C, 16C)), but broken off in most specimens (e.g., Figs 3E, 8F, 13F, 16F, 18C); spermathecae ovoid, fertilization ducts slightly curved an attaching laterally at atrium (Fig. 6A, B).

Composition. *Leviana dimidiata* (L. Koch, 1871) comb. nov.; *L. cincinnata* sp. nov.; *L. folium* sp. nov., *L. minima* sp. nov.; *L. mulieraria* (Keyserling, 1887).

Distribution. Tropical, east and south-eastern Australia (Australian Capital Territory (inferred), New South Wales, Northern Territory, Queensland, Victoria, Western Australia) (Figs 9, 14).

Key to adult males and females of *Leviana* gen. nov.

1 Total length of spiders 3 mm or less ..... *L. minima* sp. nov.
– Total length of spiders more than 3.5 mm 2
2 Abdomen olive-green to light yellow-brown with a central anterior white mark only, no black markings present (Figs 10A, 11A) ..... *L. cincinnata* sp. nov.
– Abdomen of different colouration and always with some dark grey to blacks marks (e.g. Figs 7A, 78, 17A, 18A) or dark folium pattern (e.g. Figs 12A, 13A, 14A) 3
3 Abdomen elongate cylindrical (Figs 17A, 18A); median apophysis of male pedipalp apically narrowing (Fig. 17C); epigyne without bulging atrium (Fig. 18C) ..... *L. mulieraria* (Keyserling) comb. nov.
– Abdomen ovoid (Figs 7A, 8A, 12A, 13A); median apophysis of male pedipalp apically broadly lobed (Figs 7C, 12C); epigyne atrium centrally bulging (Figs 8C, 13C) 4
4 Anterior dark shoulder marks forming an acute angle, i.e. the lighter abdomen incises deeply between anterior mark and lateral dark line (Figs 12A, 13A, arrow); conductor of male pedipalp less than twice as wide as high (Fig. 12C); base of epigyne scape (if present) protruding anteriorly (Fig. 13C) ..... *L. folium* sp. nov.
– Anterior dark shoulder forming a right to obtuse angle and therefore the lighter abdomen does not incise deeply between anterior dark shoulder and lateral dark line (Figs 7A, 8A arrow); conductor of male pedipalp in ventral view twice as wide as high (Fig. 7C); base of epigyne scape (if present) not protruding anteriorly (Fig. 8C) ..... *L. dimidiata* (L. Koch) comb. nov.

Leviana dimidiata (L. Koch, 1871) comb. nov.

Figs 1A–D, 4A, B, 5A–C, 6A, 7A–D, 8A–F, 9

Epeira dimidiata Koch 1871: 95–96, plate 8, figs 1, 1a.

Epeira sylvicola Rainbow 1897: 518–519, plate 17, figs 4, 4a. New synonymy.

Araneus sylvicola (Rainbow).- Rainbow 1909: 222.

Araneus dimidiatus (L. Koch).- Rainbow 1911: 184; Rainbow 1916: 100; Bonnet 1955: 498; Rack 1961: 22.

Araneus sylvicolus (Rainbow).- Rainbow 1911: 194.

Aranea dimidiata (L. Koch).- Roewer 1942: 827.

Aranea sylvicola (Rainbow).- Roewer 1942: 834.

Araneus silvicola (Rainbow).- Bonnet 1955: 598 (corrected spelling; '*silva*' – Latin: wood).

Type material. ***Syntypes*** of *Epeira dimidiata* L. Koch, 1871: 1 female, Mackay (21°08'S, 149°11'E, Queensland, Australia) (ZMH, (Rack 1961)-catalogue no. 235) (examined); 2 females, same locality (L. Koch collection) (NHMUK 1915.3.5.594–595) (examined).

Syntypes of *Epeira sylvicola* Rainbow, 1897: 2 females, Guildford (33°50'S, 150°59'E, New South Wales, Australia) (AM KS.6679) (examined).

Other material examined. AUSTRALIA: **New South Wales:** 2 males, Beecroft, 33°45'S, 151°04'E (AM KS.53874, KS70922); 2 males, 1 female, Beecroft Reserve, 33°45'S, 151°04'E (AM KS.54073, KS.58718, KS.66205); 1 female, Bellevue Hill, Sydney, 33°53'S, 151°17'E (AM KS.70044); 1 male, Bonny Hills Road, off Pacific Highway, S of Port Macquarie, 31°33'S, 152°49'E (AM KS.62864); 1 female, Cheltenham, 33°45'S, 151°05'E (AM KS.56988); 1 female, Como, 34°01'S, 151°04'E (AM KS.32822); 1 female, Cudgen, 28°16'S, 153°33'E (QM); 12 females, 4 juv., Enfield, 33°53'S, 151°06'E (AM KS.33984); 1 male, Forster, 6 km S, 32°12'S, 152°31'E (AM KS.10204); 1 female, Frazer Reserve, Wahroonga, 33°43'S, 151°08'E (AM KS.56766); 1 female, Galston, Crosslands Road, 33°38'S, 151°05'E (AM KS.83701); 1 female, Gosford, 33°25'S, 151°20'E (MV K-10331); 1 female, Jamberoo Mountain, 34°43'S, 151°18'E (AM KS.81993); 1 female, Lake Munmorah State Recreation Reserve, Geebung, 22°12'S, 151°34'E (AM KS.17794); 1 female, same locality (AM KS.17811); 1 male, Maroota State Forest, 33°31'S, 150°59'E (AM KS.73416); 1 female, Medlow Bath, 33°41'S, 150°17'E (AM KS.34097); 1 female, Minnamurra Falls, 34°38'S, 150°44'E (AM KS.100355); 1 female, Moruya, 35°55'S, 150°05'E (AM KS.33981); 2 females, Narara, 33°23'S, 151°21'E (MV K-10332); 1 male, O'Hares Creek, 34°14'S, 150°52'E (AM KS.86691); 1 female, Port Stephens, south shore, 32°42'S, 152°06'E (AM KS.33983); 1 female, Wahroonga, 33°43'S, 151°08'E (AM KS.46010); 1 female, Wallumatta Nature Reserve, North Ryde, 33°48'S, 151°07'E (AM KS.81958); 1 male, Warrumbungles National Park, White Gum carpark area, 31°17'20"S, 149°02'26"E (AM KS.75194); 2 males, 1 female, Warrumbungles National Park, 0.9 km E of western entrance to park, 31°16'35"S, 148°57'49"E (AM KS.75238);

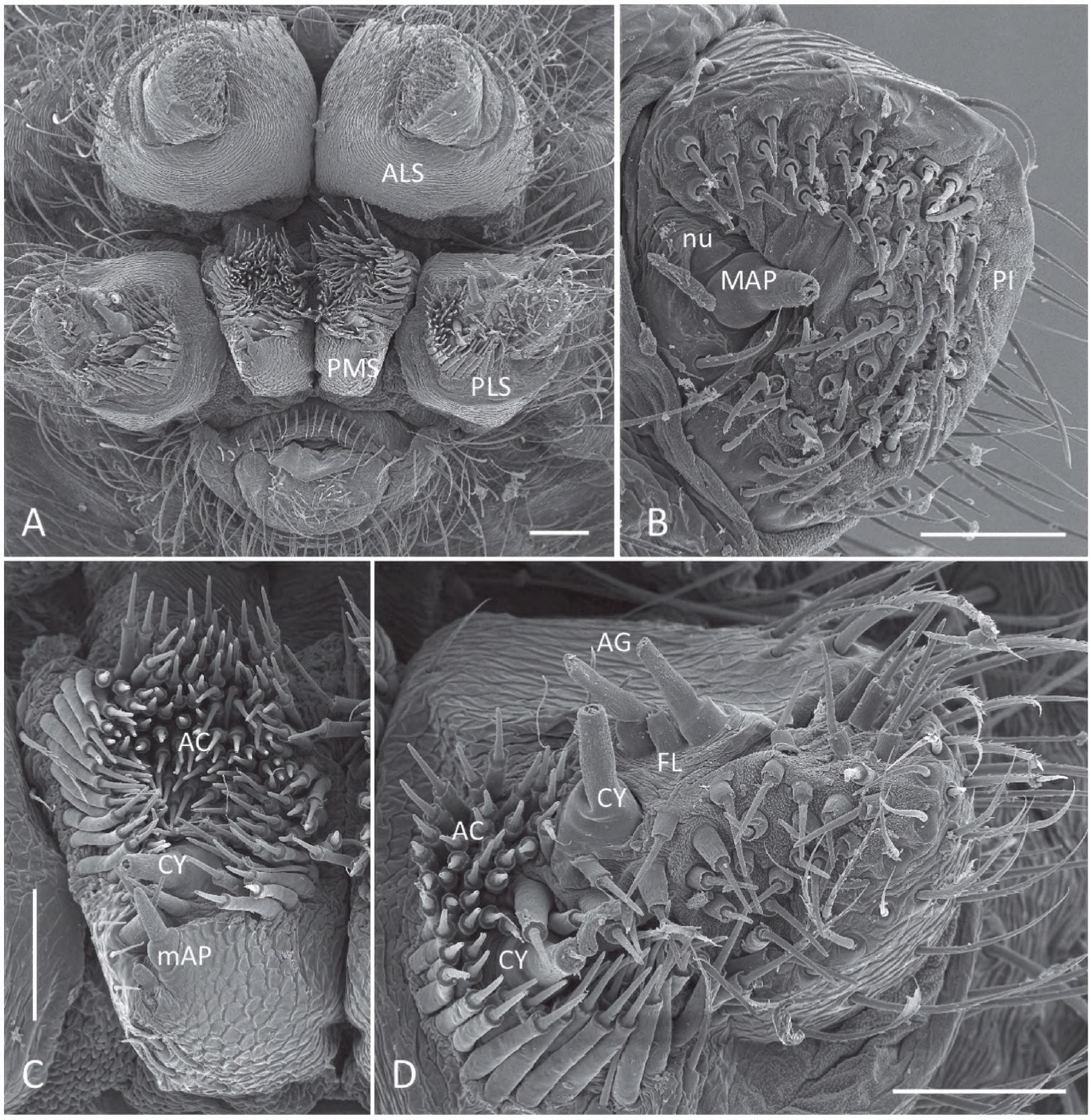


Figure 2. *Leviana folium* sp. nov. Scanning Electron Micrographs (SEM) of female spinnerets of (NHMD 12199). **A.** Spinnerets, ventral view; **B.** Left anterior lateral spinnerets (ALS), ventral view; **C.** Right posterior median spinnerets (PMS), ventral view; **D.** Left posterior lateral spinneret (PLS), ventral view. Scale bars: 0.1 mm (**A, C, D**); 0.05 mm (**B**).

1 female, same locality (AM KS.75239). **Queensland:** 1 male, Belmont Hills Bushlands, 27°31'S, 153°07'E (QM S54745); 2 females, same locality (QM S54746); 1 female, same locality (QM S54744); 1 female, same locality (QM); 3 females, Blackdown Tableland, Stony Creek Falls, 16°53'S, 145°39'E (QM S39784); 1 female, Boondall Wetlands, 27°20'21"S, 153°04'27"E (QM S67469); 3 females, same locality (QM); 3 females, 1 juv., same locality (QM S67470); 1 female, same locality (QM S67468); 1 female, Boonoo Boonoo, 28°53'S, 152°06'E (QM S39797); 1 male, Bribie Island, 27°03'30"S, 153°11'32"E (AM KS.69544); 1 male, same locality (AM KS.69516); 2 males, same locality (AM KS.69609); 2 females, 11 juv., Brisbane, 27°28'S, 153°01'E (QM S39789); 1 female, same locality (QM S69647); 1 female, Buhot Creek, Burbank, 27°35'27"S, 153°10'19"E (QM S67807); 1 male, same locality (QM S67283); 3 males, same locality (QM S67282); 1 female, same locality (QM); 2 males, 1 female, same locality (QM S67628); 1 males, same locality (QM S111921); 1 male, 3 females, Bulimba Creek, Carindale, 27°30'9"S, 153°06'03"E (QM S67467); 1 female, same locality (QM S67466); 1 female, same locality (QM S67463); 1 male, same locality (QM S67461); 1 female, same locality (QM S67464); 6 males, 6 females, same locality (QM S67462); 1 female, Bundaberg Forest, 24°52'S, 152°21'E (QM); 1 female,

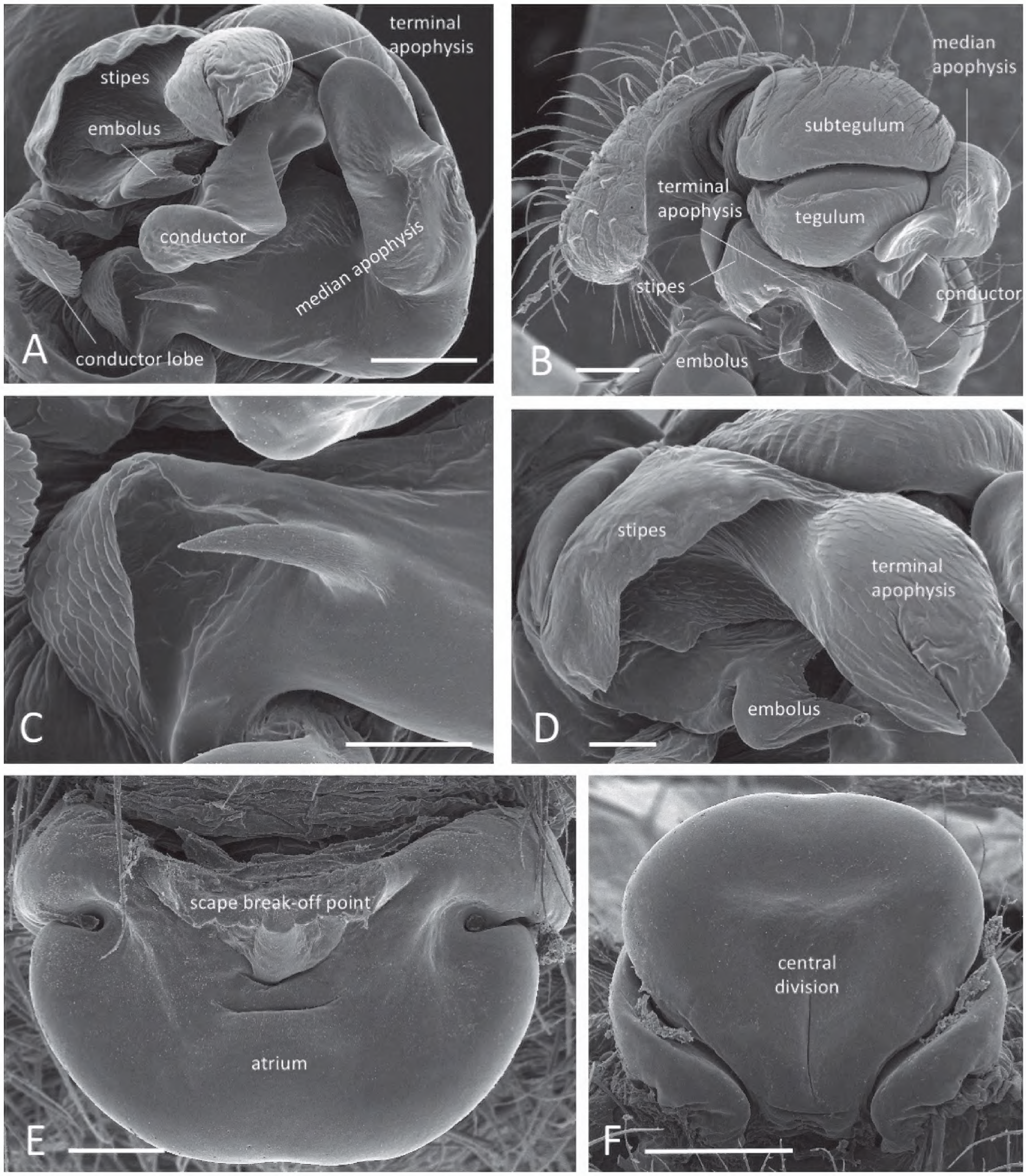


Figure 3. *Leviana folium* sp. nov. Scanning Electron Micrographs (SEM) of male (**A–D**; ZMUC 12203) and female (**E–F**; ZMUC 12199) genitalia. **A.** Left pedipalp bulb, ventral view; **B.** Left pedipalp bulb, apico-dorsal view; **C.** Basal arch and spine of median apophysis, left pedipalp, ventral view; **D.** Distal section of pedipalp bulb, apical view; E, epigyne, ventral view; **F.** Epigyne, posterior view. Scale bars: 0.1 mm (**A, B, F**); 0.05 mm (**C–E**).

Bundaberg, Baldwins Swamp, 24°52'S, 152°21'E (QM S25246); 1 female, Bundaberg, land, 24°52'S, 152°21'E (MV K-10345); 12 females, Camp Milo, Cooloola, 26°00'S, 153°05'E (QM S39750); 1 female, Chelsea Road Bushland Reserve, 27°28'58"S, 153°11'15"E (QM); 2 females, same locality (QM); 4 females, same locality (QM S65837); 2 females, same locality (QM S65840); 1 female, Closeburn, 27°20'S, 152°52'E (QM S39766); 3 females, Consuelo Tablelands, Foleys Yards, 25°01'S, 147°57'E (QM); 2 females, Cooloola, 26°12'S, 153°03'E (QM S39753); 1 female, Cooloola State Forest, 26°12'S, 153°03'E (QM S33393); 1 female, Coombabah Creek 200 m upstream Lakeside Caravan Park, 27°52'S, 153°22'E (QM S39769); 2 females, Curtis Island,

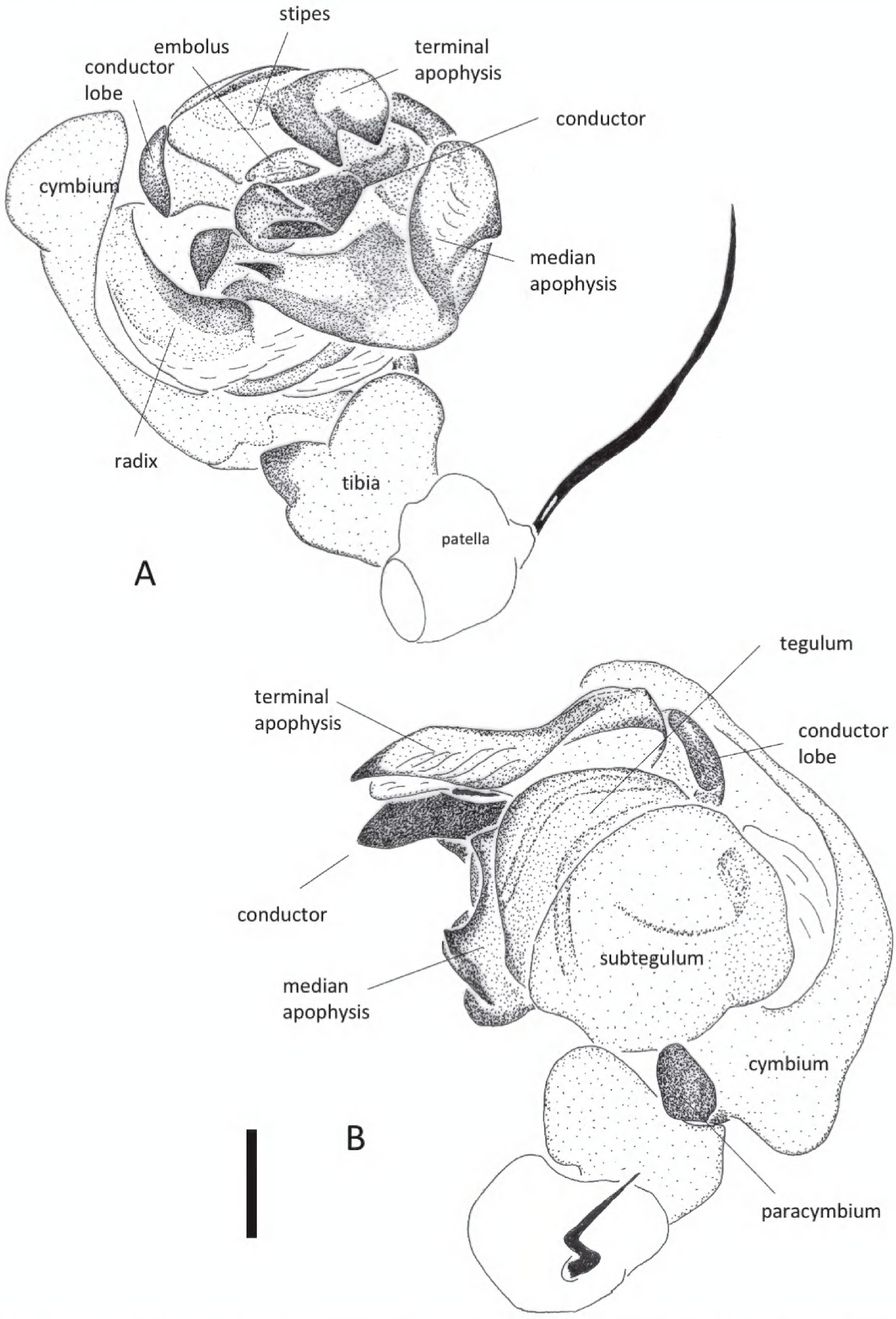


Figure 4. *Leviana dimidiata* comb. nov., interpretation of the male pedipalp anatomy (QM S54745). **A.** Ventral view; **B.** Dorsal view. Scale bar: 0.2 mm.

23°37'S, 151°9'E (QM S69916); 1 female, Deepwater National Park, 24°32'S, 151°58'E (QM S25402); 1 female, Downfall Creek, 27°23'S, 153°01'E (QM); 1 female, Drewvale, Illaweena Street, 27°38'39"S, 153°03'47"E (QM); 1 female, same locality (QM); 5 females, same locality (QM S65839); 1 female, Eidsvold, 25°22'S, 151°07'E (QM S39765); 1 female, Enoggera Army land, Brisbane, 27°26'S, 152°59'E (QM S22429); 1 female, Expedition Range National Park, 25°12'S, 148°59'E (QM S44180); 1 male, 5 females, 9 juv., Finch Hatton National Park, 21°9'S, 148°38'E (QM); 1 female, Forty Mile Scrub, SW Mt Garnet, 18°05'S, 144°51'E (QM S39778); 1 female, Girraween National Park, near, 28°50'S, 151°55'E (QM S39774); 1 female, Gold Creek Reservoir, 27°27'53"S, 152°52'32"E (QM S54749); 1 female, same locality (QM S54750); 1 female, same locality (QM); 1 female, same locality (QM S54751); 1 female, same locality (QM S54748); 3 females, same locality (QM S54747); 1 female, Hann Tableland, northern end, 16°48'S, 145°10'E (QM S40510); 1 female, same locality (QM S41332); 3 females, same locality (QM S40498); 2 females, Helidon, 27°33'S, 152°08'E (QM S39795); 1 female, Hurdie Gully, 14.8 km WSW Monto, 24°55'S, 150°59'E (QM S44168); 1 female, Ipswich, 27°37'S, 152°47'E (QM S39763); 2 females, Karawatha Forest, 27°37'33"S, 153°05'24"E (QM S67460); 1 female, same locality (QM); 2 males, same locality (QM S67459); 1 female, Kenniffs Cave, Mt Moffat, 25°01'S, 147°57'E (QM); 1 female, same locality (QM); 1 female, Kroombit Tops, 24°22'S, 151°01'E (QM); 1 female, same locality (QM); 4 females, same locality (QM S39751); 2 females, Kroombit Tops, Lower Dry Creek, 24°24'S, 151°01'E (QM); 7 females, Kroombit Tops, Upper Dry Creek, 24°25'S, 151°03'E (QM); 4 females, Kroombit Tops, Northern Escarpment, 24°22'S, 151°01'E (QM); 1 female, Kroombit Tops, Upper Kroombit Creek, 24°25'S, 151°03'E (QM); 1 female, Kroombit Tops, Upper TA47 Creek, 24°25'S, 151°03'E (QM); 1 female, Kuraby, 27°37'S, 153°05'E (QM S41023); 1 male, 1 female, Mahogany Forest, Mt Moffat National Park, 24°56'S, 148°04'E (QM S111925); 2 females, Molangdool, 24°45'S, 151°33'E (AM KS.33985); 1 female, Moreton Island, 27°11'S, 153°24'E (QM S39782); 15 females, Mt Abbott, 20°06'S, 147°45'E (QM S38572); 1 female, Mt Coolum, 26°34'S, 153°05'E (QM S111923); 1 female, same locality (QM); 1 female, Mt Flinders, 22°32'S, 150°46'E (QM S39768); 1 female, Mt Garnet, 17°41'S, 145°07'E (QM); 1 female, Mt Moffat National Park, 25°01'S, 147°57'E (QM); 1 female, Mt Moffat, summit, 25°01'S, 147°57'E (QM); 1 female, 1 juv., Mt Moffat, top camp, 25°01'S, 147°57'E (QM S111924); 2 males, 2 females, 3 juv., Nelson, 12°38'S, 143°15'E (AM KS.32825); 7 females, Nerimberah, via Rockhampton, 23°24'S, 150°35'E (QM S9923); 1 female, North Stradbroke Island, 27°35'S, 153°27'E (QM S55768); 2 females, same locality (QM S55769); 3 females, same locality (QM S55744); 7 females, same locality (QM S55632); 2 females, same locality (QM S55743); 4 females, same locality (QM S56284); 2 females, same locality (QM S55631); 1 female, same locality (QM S55745); 1 female, same locality (MV K-10333); 1 female, Orchid Beach, Fraser Island, 24°58'S, 153°19'E (QM S31029); 2 females, Peel Island, 27°30'S, 153°21'E (QM S39748); 1 female, Percy Island, 21°24'S, 150°20'E (QM S39787); 2 females, Ransome Reserve, 27°29'34"S, 153°11'05"E (QM); 1 male, same locality (QM); 4 females, same locality (QM); 2 females, same locality (QM S65838); 3 males, 1 female, same locality (QM S65841); 1 female, Rochedale, 27°37'S, 153°9'E (QM S39757); 1 female, same locality (QM S39760); 3 males, 6 females, 2 juv., Rochedale State Forest, 27°37'S, 153°09'E (QM S39754); 1 female, same locality (QM S39759); 1 female, same locality (QM S39758); 1 female, same locality (QM S39755); 1 female, same locality (QM); 2 females, same locality (QM S39756); 1 female, Rundle Shale camp site, 23°39'S, 150°59'E (QM S39781); 1 female, South Percy Island, Central Valley, 21°45'S, 150°19'E (QM S33318); 1 female, South Percy Island, NW Bay, 21°45'S, 150°19'E (QM); 2 females, Stanthorpe, 28°40'S, 151°56'E (QM S39783); 1 male, Taringabah, 17°43'S, 145°56'E (QM S39770); 1 female, Teewah Creek, Cooloola, 26°05'S, 153°02'E (QM S39788); 1 male, 3 females, 1 juv., Teviot Brook, Boonah, 27°55'S, 152°33'E (QM S39762); 1 female, Top Moffat Camp, Mt Moffat National Park, 25°01'S, 147°05'E (QM S111926); 1 female, Upper Brookfield, 27°30'S, 152°55'E (QM S39796); 1 female, Warro, via Lowmead, 26°56'S, 150°55'E (QM S39779); 1 female, Woodgate, 25°06'S, 152°34'E (QM S39780); 10 females, Yeppoon, Emu Park, Rockhampton, 23°16'S, 150°05'E (QM S69646); 1 female, same locality (QM S39761); **Victoria:** 2 females, Bruthen, 37°42'S, 147°50'E (MV K-10335); 2 females, Dermody's Camp, Avon River State Forest, 37°48'17"S, 146°55'03"E (WAM T68049).

Diagnosis. *Leviana dimidiata* comb. nov. is most similar to *L. folium* sp. nov. in both somatic (size, colouration) and genitalic morphology. However, they can be clearly separated by the shape of the black anterior shoulder marks and lateral lines. In *L. dimidiata* comb. nov., the anterior black marks and lateral lines form an obtuse internal angle (e.g. Figs 7A, 8A - arrows), whereas in *L. folium* sp. nov. this angle is acute (e.g. Figs 12A, 13A - arrows). Male pedipalp morphology differs subtly in some key sclerites; for example, the terminal apophysis has a sclerotised tip in *L. dimidiata* comb. nov. which is absent in *L. folium* sp. nov. (Fig. 7D vs Fig. 13D), the conductor is more prominent and more elongated and the spine in the basal arch of the median apophysis is comparatively much larger (Fig. 7C vs Fig. 12C). The base of the scape of the female epigyne protrudes further anteriorly in *L. dimidiata* comb. nov. than in *L. folium* sp. nov. (Fig. 8C vs Fig. 13C).

Description. Male (based on QM S111921). Total length 6.6. ***Carapace*** (Fig. 7A) 3.4 long, 2.3 wide; light brown centrally with dark brown lateral flanks; white setae mainly in cephalic and centrally lighter area; fovea indistinct roundish depression. ***Eyes*:** AME 0.20, ALE

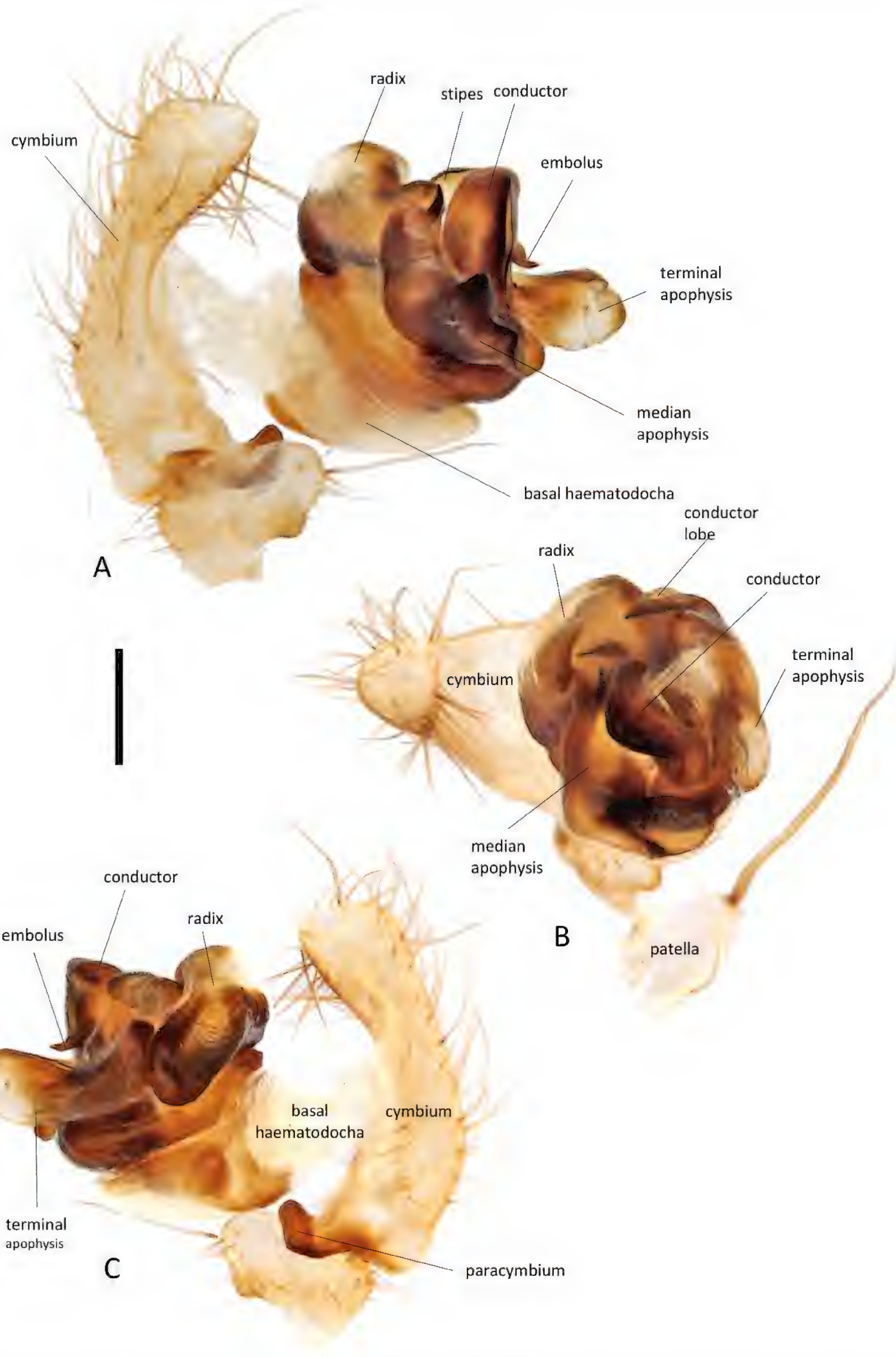


Figure 5. *Leviana dimidiata* comb. nov., expanded male pedipalp (QM S111921). **A.** Ventral view; **B.** Apical view; **C.** Dorsal view. Scale bar: 0.2 mm.

0.13, PME 0.14, PLE 0.14; row of eyes: AME 0.48, PME 0.44, PLE 1.12. ***Sternum*** (Fig. 7B) 1.6 long, 1.1 wide; orange-brown; heavy dark grey pigmentation towards margins; few white setae; few brown bristles marginally. ***Labium*** subtriangular, 0.48 long, 0.51 wide; basally dark reddish-brown. ***Maxillae*** yellow-brown. Chelicerae dark-brown; few white setae in basal half; three retromarginal teeth of equal size, four promarginal teeth with the second-basal one largest. ***Legs*:** leg formula I > II > IV > III; dark brown with distinct yellow-brown annulations; lengths of segments (femur + patella + tibia + metatarsus + tarsus = total leg length): pedipalp 0.8 + 0.2 + 0.2 + – + 1.0 = 2.2, I 3.5 + 1.5 + 3.2 + 3.4 + 1.3 = 12.9, II 2.9 + 1.4 + 2.4 + 2.9 + 1.1 = 10.7, III 1.9 + 0.8 + 1.1 + 1.3 + 0.8 = 5.9, IV 2.4 + 1.1 + 2.8 + 2.9 + 0.8 = 8.1. ***Abdomen*** (Fig. 7A, B) 3.7 long, 2.4 wide; elongate ovoid; dorsally yellow-grey becoming darker posteriorly; two black central marking anteriorly that continue laterally as black lines almost to spinnerets; four pairs of dark brown sigilla centrally; covered with long brown bristles and white setae; venter centrally dark grey with two longitudinal lateral lighter bands, covered with brown setae; spinnerets light brown.

Pedipalps (Figs 7C, D; also 4A, B, 5A–C): median apophysis apically broadly lobed, basally with thorn opposing a hooded base; terminal apophysis fleshy, elongated with double-tip; embolus with broad base, curved and short tip; conductor wider than high in ventral view.

Female (based on QM S67628; epigyne variation QM S25402). Total length 7.1. ***Carapace*** (Figs 8A) 3.5 long, 2.6 wide; light yellowish-brown, cephalic area somewhat darker and with a dark brown median band; few white setae in particular in cephalic area; fovea shallow and poorly demarcated. ***Eyes*:** AME 0.18, ALE 0.15, PME 0.13, PLE 0.11; row of eyes: AME 0.46, PME 0.35, PLE 1.23. ***Sternum*** (Fig. 8B) 1.8 long, 1.3 wide; yellowish-brown; dark brown pigmentation laterally; covered with few white setae; few long brown bristles marginally. ***Labium*** 0.64 long, 0.44 wide, colouration as male. ***Maxillae*** as male. Chelicerae dark brown; few white setae in basal half, black setae mesally mainly in apical half; four promarginal teeth, with the apical and third one largest; three retromarginal teeth of similar size. ***Legs*:** leg formula I > II > IV > III; light brown with indistinct darker annulations, most distinct on tibiae and metatarsi of leg III and IV; lengths of segments (femur + patella + tibia + metatarsus + tarsus = total length of leg): pedipalp 1.0 + 0.3 + 0.2 + – + 0.8 = 2.3, I 2.9 + 1.5 + 2.3 + 2.4 + 1.1 = 10.2, II 2.6 + 1.1 + 1.9 + 2.1 + 0.8 = 8.5, III 1.6 + 1.0 + 1.5 + 1.1 + 0.6 = 5.8, IV 2.7 + 1.1 + 1.8 + 1.9 + 0.8 = 8.3. ***Abdomen*** (Fig. 8A, B) 3.5 long, 3.2 wide; ovoid, slightly dorsoventrally compressed; dorsal colour pattern and setae largely as male, however lighter; venter as male, but with narrow light guanine line laterally; spinnerets brown.

Epigyne (Fig. 8C–F) ovoid wider than long, atrium bulging; central division broadly oval with narrow base; scape with almost parallel lateral border, almost translucent; often broken off anteriorly; spermathecae ovoid, almost touching centrally; fertilization duct very slightly curved and attaching laterally at atrium (Fig. 6A).

Variation. Males total length 4.8–6.6 (n = 5); females total length 6.4–9.9 (n = 7). There is little colour variation in males and females of this species, although the posterior part of the abdomen might be darker than in the specimens illustrated. Two out of seven females measured for this study had their epigyne scape intact.

Remarks. Rack (1961) considered a female in the ZMH the holotype of *Epeira dimidiata*, however, two further females from the type locality lodged in the NHMUK clearly bear the typical labels of L. Koch which suggests these to by syntypes. The original description does not state the number of specimens on which the description was based, and we therefore con-

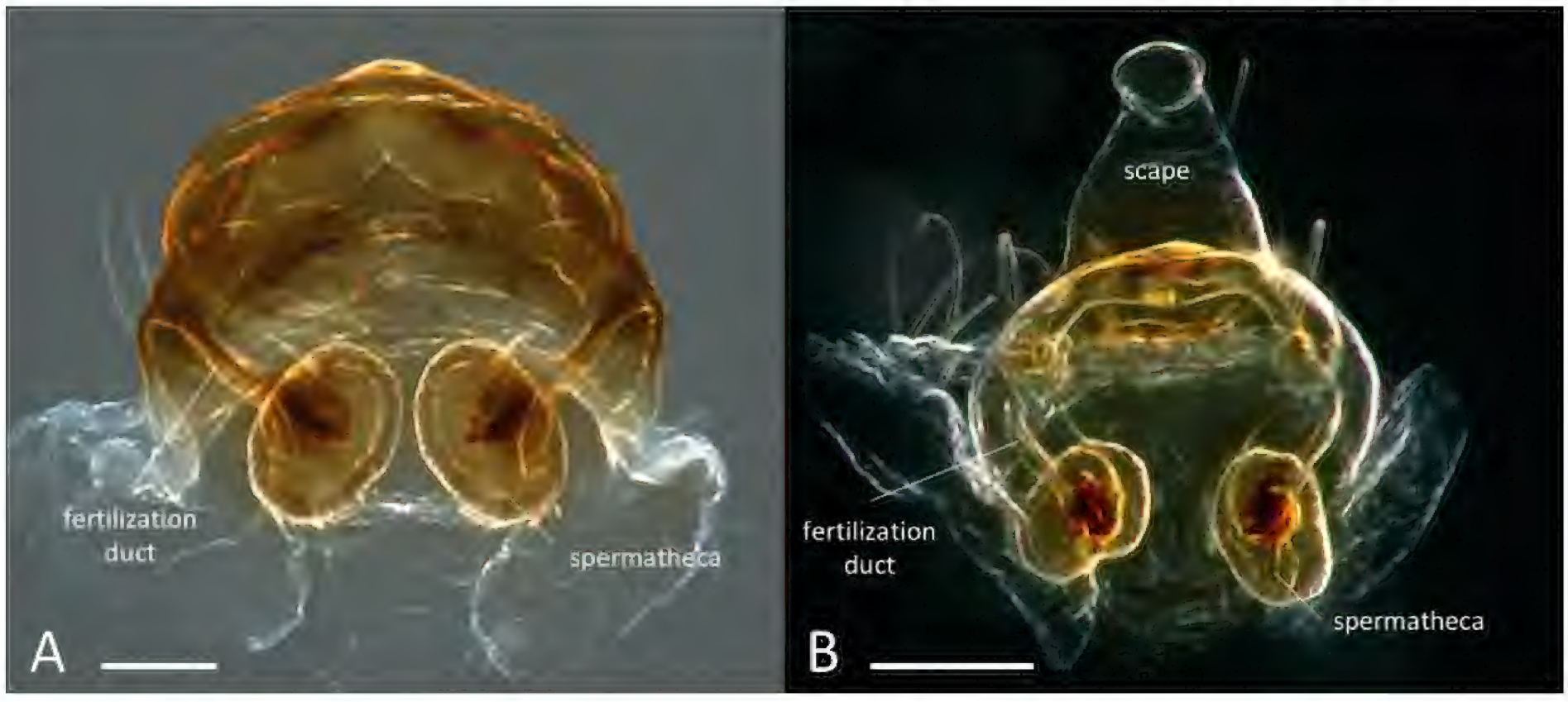


Figure 6. *Leviana* gen. nov., cleared epigynes, posterior view. **A.** *L. dimidiata* comb. nov. (AM KS.81993); **B.** *L. cincinnata* sp. nov. (QM S111931). Scale bars: 0.05 mm.

sider all specimens from Port McKay in the ZMH and NHMUK as syntypes.

The syntypes of *Araneus sylvicolus* (Rainbow, 1897) are clearly conspecific with those of *L. dimidiata* comb. nov. based on genitalic and somatic morphology, considering the intraspecific variation as described here. We therefore consider *E. sylvicola* Rainbow, 1897 a junior synonym of *L. dimidiata* (L. Koch, 1871) comb. nov.

Life history and habitat preferences. Adult males were mainly found between September and January, with

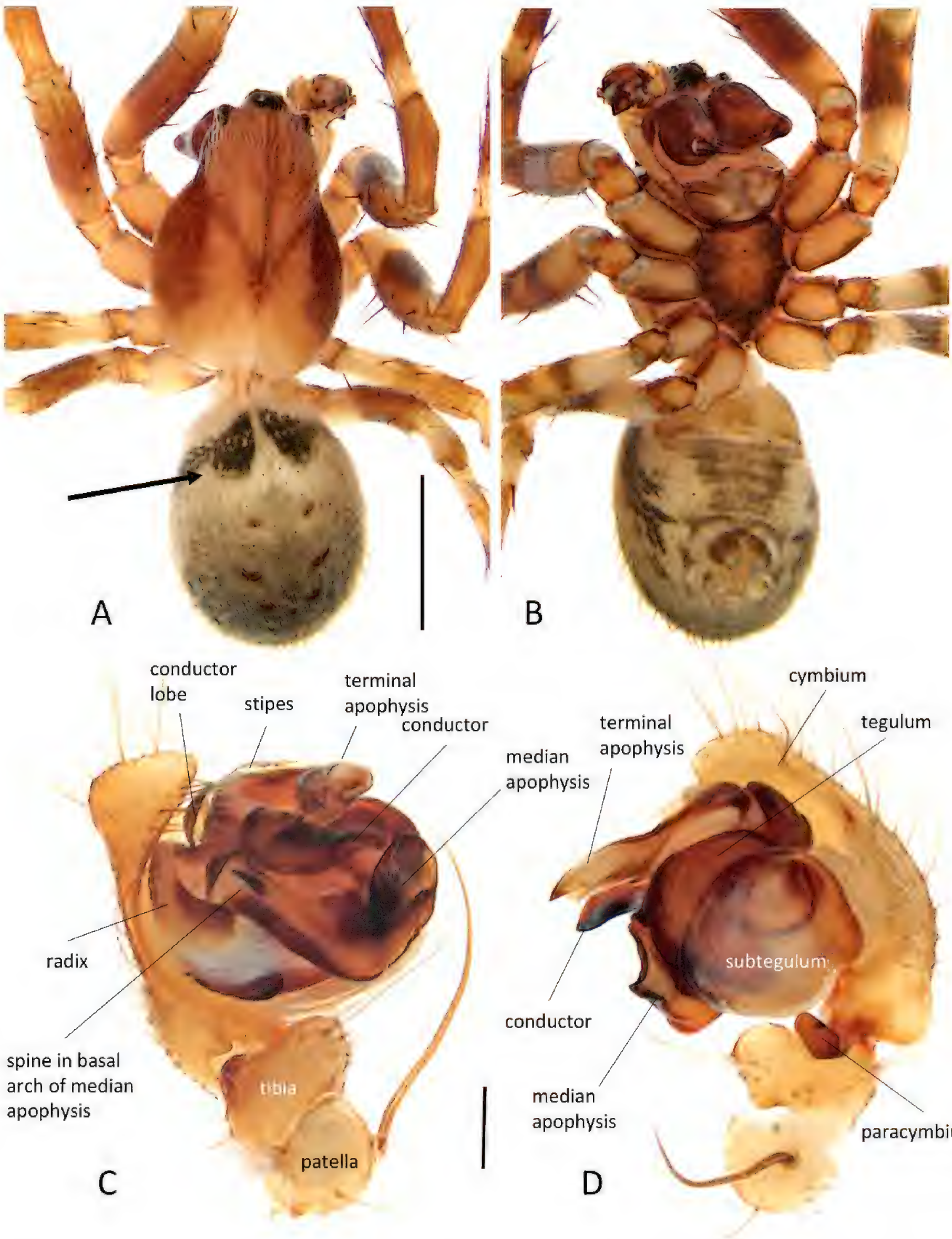


Figure 7. *Leviana dimidiata* comb. nov., male (QM S111921). **A.** Habitus, dorsal view; **B.** Habitus, ventral view; **C.** Left male pedipalp, ventral view; left male pedipalp, dorsal view. Scale bars: 2 mm (**A, B**); 0.2 mm (**C, D**). Arrow in (**A**) points to diagnostic character distinguishing *L. dimidiata* comb. nov. and *L. folium* sp. nov.

a peak in November. Mature females were mainly found between September and April, with two peaks in December and February.

Records of *L. dimidiata* comb. nov. are from a variety of open and closed forests and woodlands, including those of eucalypt, *Casuarina* and *Melaleuca*. However, there are also some records from heathlands and vine scrubs.

Distribution. Eastern Australia from far north Queensland to eastern Victoria (Fig. 9).

Leviana cincinnata sp. nov.

https://zoobank.org/28693752-B8B9-4C20-9E75-BB5505F77C71

Figs 10A–D, 11A–F, 9

Types material. ***Holotype*:** Male, Bellenden Ker Range, North Queensland, Cable Tower 3 (17°16'S, 145°51'E, Queensland, Australia), 25–31 October 1981, sweeping, Earthwatch/Qld Museum (QM S26364).

Etymology. The specific epithet is an adjective in apposition (*cincinnatus* Latin – curly) and refers to the leaf-curling behaviour of this species and other species in the genus.

Other material examined. AUSTRALIA: ***Queensland*:** 2 females, Bartle Frere, W Base, 17°23'S, 145°46'E (QM S47286); 5 males, 5 females, Bellenden Ker Range, 0.5 km S Cable Tower 7, 17°16'S, 145°51'E (QM S27792); 5 males, 14 juv., Bellenden Ker, Cable Tower 3, 17°16'S, 145°51'E (QM S26348, S26359); 1 female, same locality (QM S111931); 3 females, Boulder Creek, via Tully, 17°50'S, 145°54'E (QM S111929); 4 male, 6 females, 3 juv., Cardwell Range, Upper Broadwater Creek Valley, 18°18'S, 145°56'E (QM S111927–8); 1 male, 2 females, Graham Range, 17°17'S, 145°57'E (QM S38010–11, S38013); 1 female, 1 juv., same, same locality (QM); 1 female, Lambs Head, 10 km W Edmonton, 17°02'S, 145°38'E (QM S41509); 1 male, Mt Demi summit, 7 km SW Mosman, 16°30'S, 145°19'E (QM S38122); 1 female, Mt Formatine South, 10 km N Kuranda, 16°43'S, 145°37'E (QM S19764); 1 female, Mt Spurgeon, 2 km SE, via Mt Carbine, 16°26'S, 145°12'E (QM S16535); 1 male, Mt Spurgeon, 7 km N, 16°22'S, 145°13'E (QM S111930); 6 males, 7 females, North Bell Peak, Malbon Thompson Range, 17°07'S, 145°54'E (QM S22652, S22767, S22879, S22999); 3 males, 2 females, same locality (QM); 1 female, Ravenshoe, 17°37'S, 145°29'E (QM); 4 females, Upper Boulder Creek, 11 km NNW of Tully, 17°50'S, 145°54'E (QM S33868); 3 females, same locality (QM); 2 females, Upper Plath Road, 17°23'S, 145°28'E (QM S46913); 1 male, Walter Hill Range, 17°47'S, 145°49'E (QM S41125).

Diagnosis. *Leviana cincinnata* sp. nov. differs distinctly from all other species in the genus by its uniform olive-grey abdominal colouration with only a white patch antero-centrally. All other species of *Leviana* gen. nov. have some dark to black abdominal markings. Male genital morphology is most similar to *L. dimidiata* comb. nov. due to the broadly lobed tip of the median apophysis and the strong spine in the basal arch of the median apophysis, but both species distinctly differ in the strong sclerotization of the conductor in *L. dimidiata* comb. nov., that is absent in *L. cincinnata* sp. nov. (Fig. 7C vs Fig. 10C). The epigyne scape is much broader than in any other species of *Leviana* comb. nov.

Description. Male (based on holotype; QM S26364). Total length 3.4. ***Carapace*** (Fig. 10A) 2.1 long, 1.5 wide; uniformly yellow-brown, somewhat lighter in cephalic area; very few white setae mainly in cephalic area; fovea indistinct broad depression. ***Eyes*:** AME 0.11, ALE 0.10, PME 0.11, PLE 0.10; row of eyes: AME 0.35, PME 0.29, PLE 0.79. ***Sternum*** (Fig. 10B) 1.0 long, 0.8 wide; uniformly yellow-brown with indistinct grey pigmentation; covered with few light brown setae. ***Labium*** 0.35 long, 0.22 wide; light brown. ***Maxillae*** light brown. Chelicerae light brown; few light brown setae medially; two retromarginal teeth of equal size, three promarginal teeth with the median largest. ***Legs*:** leg formula I > II > IV> III; uniformly yellowish-brown; lengths of segments (femur + patella + tibia + metatarsus + tarsus = total leg length): pedipalp 0.6 + 0.2 + 0.2 + – + 0.7 = 1.7, I 2.4 + 0.8 + 2.7 + 2.3 + 1.0 = 9.2, II 2.1 + 0.7 + 1.8 +1.6 + 0.8 = 7.0, III 1.5 + 0.6 + 0.8 + 0.6 + 0.5 = 4.0, IV 1.6 + 0.8 + 1.9 + 1.5 + 0.6 = 6.4. ***Abdomen*** (Fig. 10A, B) 2.6 long, 1.9 wide; ovoid; dorsally uniformly dark greenish-grey; white central marking anteriorly and some white speckles laterally and centrally; three pairs of dark brown sigilla centrally with the two anterior pairs largest; few light bristles and white setae; venter greenish grey with two irregular longitudinal lateral white markings, covered with few light brown setae; spinnerets yellow-brown.

Pedipalps (Fig. 10C, D): median apophysis apically broadly lobed, basally with strong thorn opposing a hooded base; terminal apophysis elongated, fleshy with double-tip; embolus short and sinuous (not visible behind conductor in Fig. 10C); conductor wider than high in ventral view.

Female (based on QM S111931; epigyne variation NHMD 12202). Total length 5.1. ***Carapace*** (Fig. 11A) 2.6 long, 2.1 wide; light yellowish-grey; few white setae in particular in cephalic area; fovea shallow and poorly demarcated. ***Eyes*:** AME 0.20, ALE 0.14, PME 0.14, PLE 0.13; row of eyes: AME 0.40, PME 0.31, PLE 0.77. ***Sternum*** (Fig. 11B) 1.2 long, 1.0 wide, light yellowish-grey; covered with few white setae. ***Labium*** 0.31 long, 0.54 wide, colouration as male. ***Maxillae*** as male. Chelicerae yellowish-brown; few white setae in basal half, black setae mesally mainly in apical half; three promarginal teeth, with the median smallest; two retromarginal teeth of similar size. ***Legs*:** leg formula I > II > IV > III; uniformly yellowish-grey; lengths of segments (femur + patella + tibia + metatarsus + tarsus = total length of leg): pedipalp 0.7 + 0.3 + 0.7 + – + 0.8 = 2.5, I 2.3+ 1.0 + 1.7 + 1.9 + 0.9 = 7.8, II 1.9 + 0.9 + 1.3 + 1.6 + 0.7 = 7.8, III 1.2 + 0.6 + 0.9 + 0.9 + 0.6 = 4.2, IV 1.8 + 0.9 + 1.3 + 1.4 + 0.7 = 6.1. ***Abdomen*** (Fig. 11A, B) 2.7 long, 2.5 wide; ovoid,

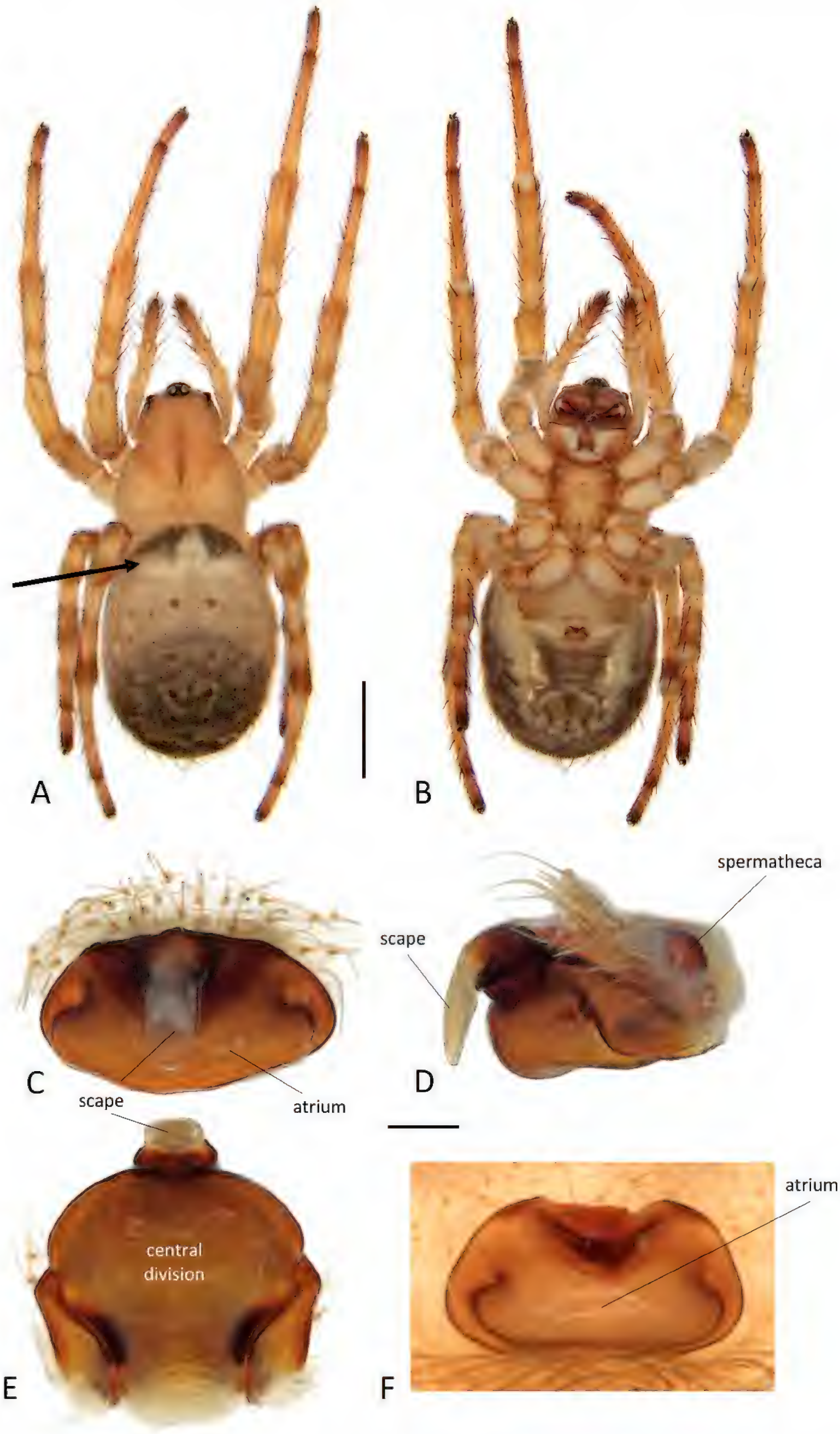


Figure 8. *Leviana dimidiata* comb. nov., female (**A, B, F** QM S67628; **C–E** QM S25402). **A.** Habitus, dorsal view; **B.** Habitus, ventral view; **C.** Epigyne, ventral view; **D.** Epigyne, lateral view; **E.** Epigyne, posterior view; **F.** Epigyne, ventral view (scape broken off). Scale bars: 2 mm (**A, B**); 0.2 mm (**C, D**). Arrow in (**A**) points to diagnostic character distinguishing *L. dimidiata* comb. nov. and *L. folium* sp. nov.

slightly dorsoventrally compressed; dorsal colour pattern and setae largely as male, but lacking lateral and median lighter patches; spinnerets brown.

Epigyne (Fig. 11C–F) base wider than long; atrium elevated, bulging; central division broadly oval with narrow base; scape broadly lipped but broken off in most specimens; spermathecae irregularly ovoid, fertilization duct slightly curved and attaching laterally at atrium (Fig. 6B).

Variation. Male total length 3.3–4.1 (n = 4); females 5.4–7.5 (n = 8). There are additional white speckles on the abdomen and white discontinuous lateral bands on the abdomens of some males and females. The epigyne scape was broken in all females measured here, with the exception of two, including the one illustrated. The colouration of live specimens is not known, but it is possible that this species displays greenish or even reddish shades when alive, which often fade into yellow-brown when preserved in ethanol.

Life history and habitat preferences. Mature males of *L. cincinnata* sp. nov. were almost exclusively found between October and December. Mature females were found between October and January, although some were found in April and one in July.

Records of *L. cincinnata* sp. nov. are almost entirely from rainforests at altitudes above 500 m. The only information on its leaf-curling behaviour was found with one specimen (QM S26348): "*spider in folded leaf of Liane with thread to tree*, *daytime*".

Distribution. *Leviana cincinnata* sp. nov. has so far only been reported from northern Queensland between about 16°20'S and 18°03'S Latitude (Fig. 9).

Leviana folium sp. nov.

https://zoobank.org/A51AA48B-7BDD-41A8-A51D-815344EF9149

Figs 2A–D, 3A–F, 12A–D, 13A–F, 14

Type material. ***Holotype*** male, Kroombit Tops (Dawes Range), 45 km SSW Calliope (24°22'S, 151°01'E, Queensland, Australia), 9–19 December 1983, open forest, V.E. Davies, J. Gallon (QM S111932).

Etymology. The specific epithet is a Latin noun in apposition (Latin *folium* – leaf) in reference to the leaf-curling behaviour of this species.

Other material examined. Australia: **New South Wales:** 1 female, Beecroft, 33°45'S, 151°04'E (AM KS.57108); 1 female, same locality (AM KS.56731); 1 male, same locality (AM KS.56735); 1 male, same locality (AM KS.76793); 1 male, same locality (AM KS.76790); 1 female, same locality (AM KS.76775); 1 female, same locality (AM KS.76791); 1 male, same locality (AM KS.84273); 1 female, same locality (AM KS.66206); 1 female, same locality (AM KS.76880); 1 male, same locality (AM KS.54443); 1 male, Beecroft Reserve, 33°45'S, 151°04'E (AM KS.58719); 1 male, same locality (AM KS.51590); 1 male, same locality (AM KS.53871);

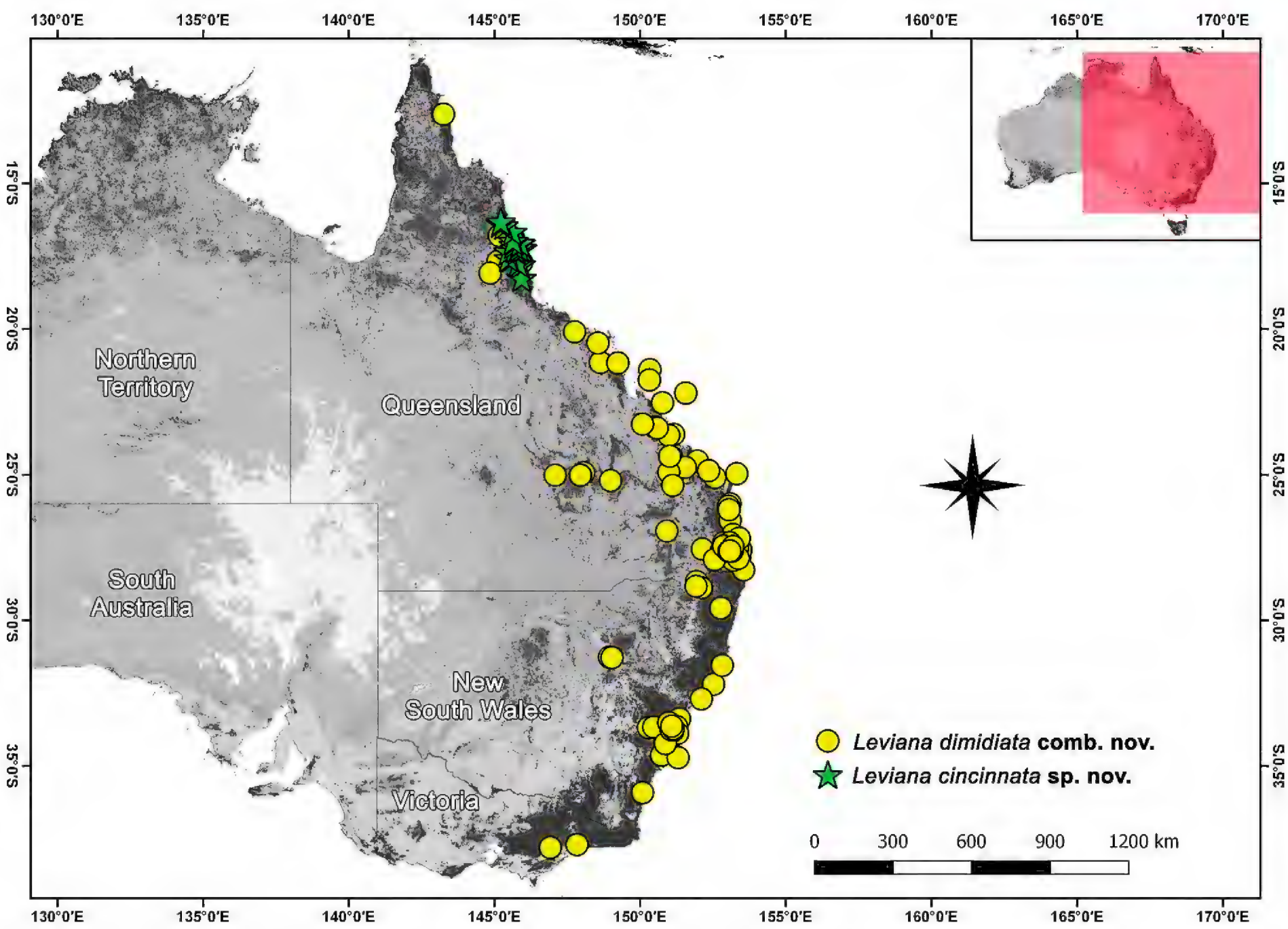
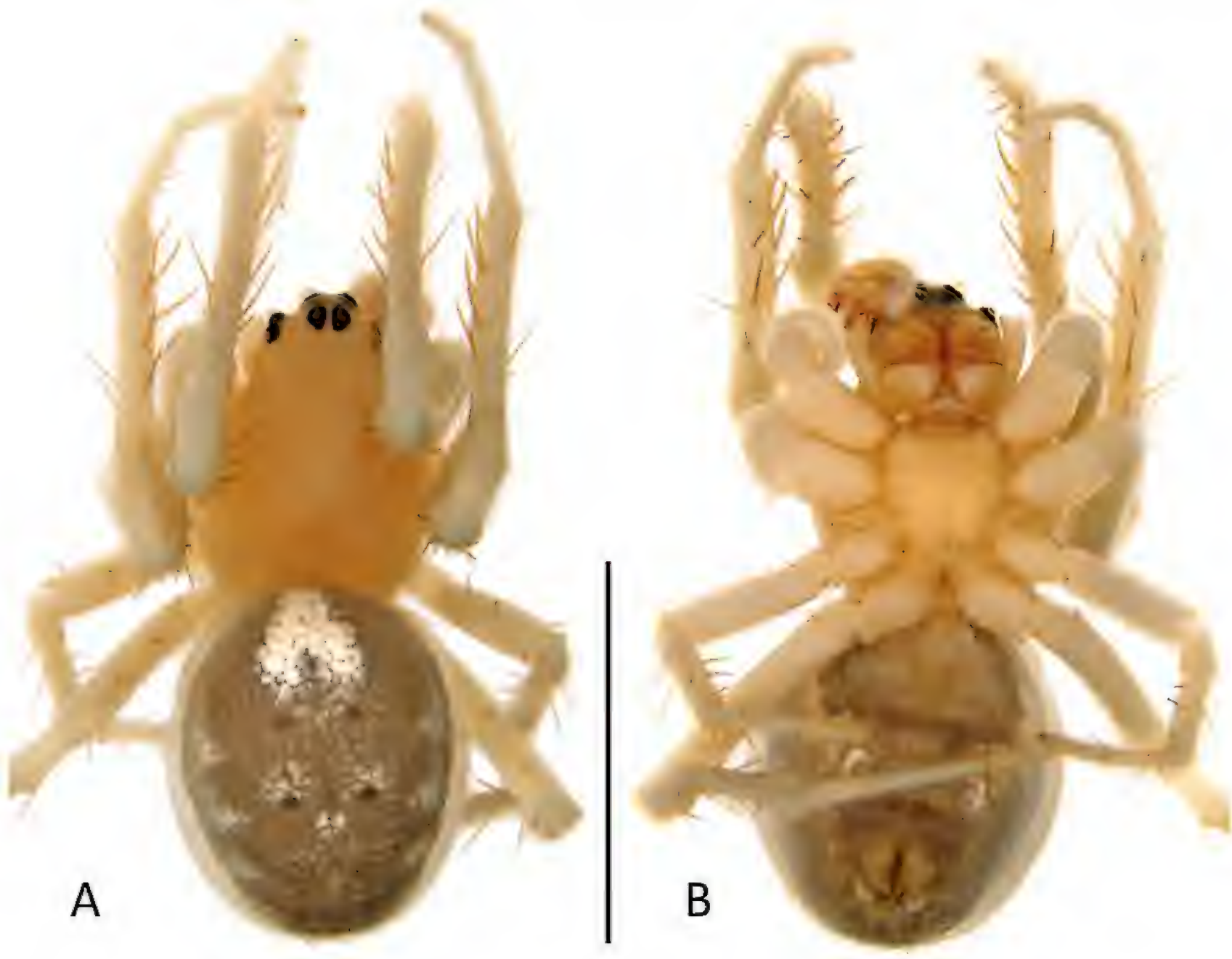


Figure 9. Distribution records of *Leviana dimidiata* comb. nov. and *L. cincinnata* sp. nov.



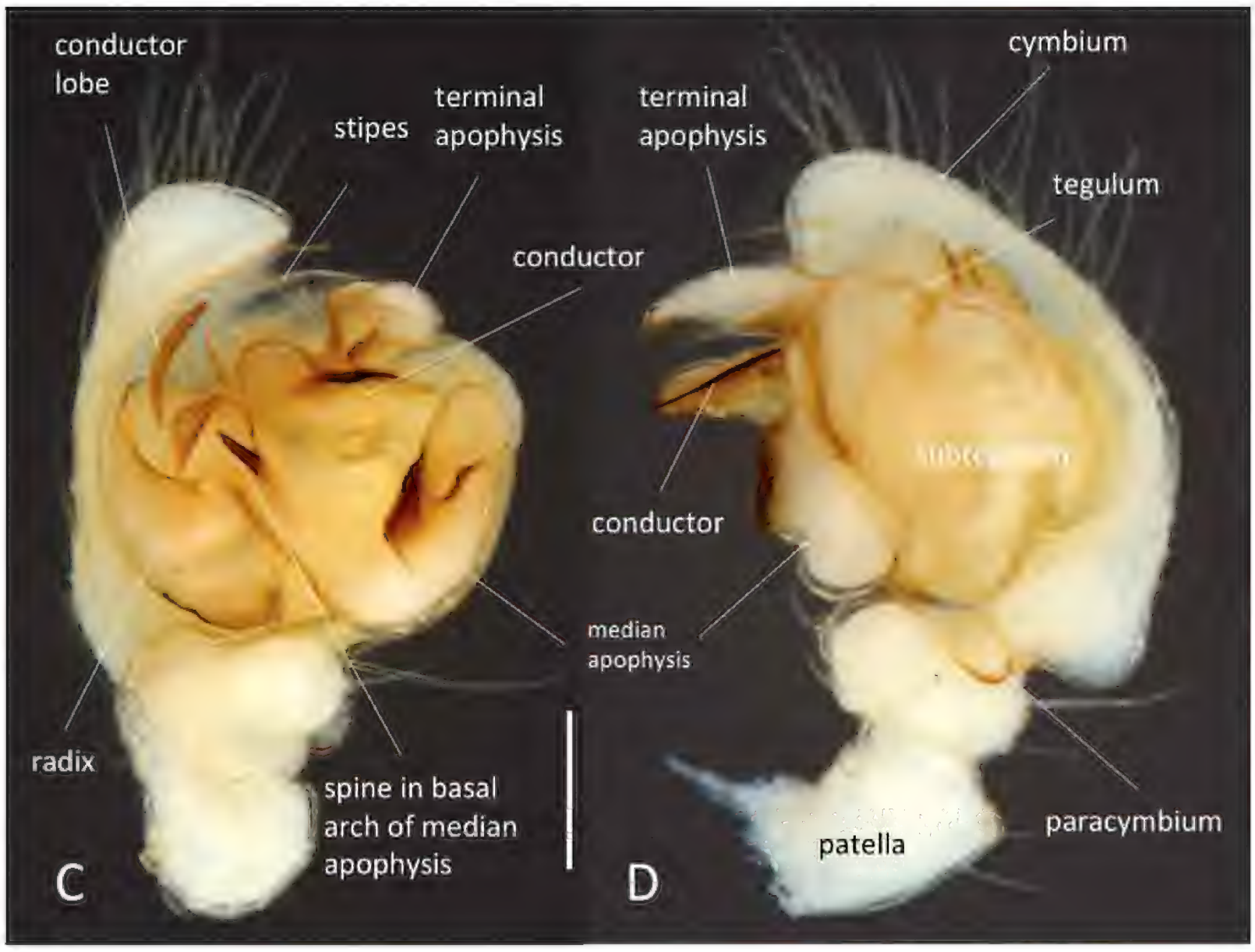


Figure 10. *Leviana cincinnata* sp. nov., male holotype (QM S26364). **A.** Habitus, dorsal view; **B.** Habitus, ventral view; **C.** Left male pedipalp, ventral view; left male pedipalp, dorsal view. Scale bars: 2 mm (**A, B**); 0.2 mm (**C, D**). Arrow in (**A**) points to diagnostic character between *L. dimidiata* sp. nov. and *L. folium* sp. nov.

1 male, same locality (AM KS.56928); 1 female, same locality (AM KS.56925); 1 male, same locality (AM KS.54423); 1 male, same locality (AM KS.51237); 1 male, Bellangry State Forest, Wilson River Flora Reserve, 31°18'S, 152°29'E (AM KS.9732); 1 female, Blackbutt Forest, 34°33'S, 150°51'E (QM S39730); 1 female, Blue Mountains, Megalong Valley, 33°39'24"S, 150°16'25"E (NHMD); 1 male, Brunswick Heads Nature Reserve, 28°32'S, 153°33'E (AM KS.9574); 1 female, 1 juv., Bruxner Park, via Coffs Harbour, 30°14'S, 153°06'E (QM); 1 male, Byles Creek, Cheltenham, 33°45'S, 151°05'E (AM KS.53456); 1 male, Hornsby, Waitara Creek, 33°42'52"S, 151°05'22"E (AM KS.79674); 1 male, Jamberoo Mountain, 34°40'S, 150°43'E (AM KS.58657); 1 male, same locality (AM KS.56748); 1 male, same locality (AM KS.58704); 1 female, same locality (AM KS.70910); 1 male, 1 female, Jamieson Park, 33°43'S, 151°18'E (AM KS.131101); 2 males, 1 female, 1 juv., Lindfield, 33°47'S, 151°10'E (AM KS.100356); 5 females, Minnamurra Falls, 34°38'S, 150°44'E (AM KS.78407); 1 female, Newport, 25km N Sydney, 33°39'07"S, 151°18'50"E (NHMD 12194); 1 female, Pennant Hills, 33°44'S, 151°04'E (AM KS.58714); 1 female, Stotts Island, 28°14'S, 153°31'E (QM S56814); 2 males, Terrigal, Wamberal Lagoon, 33°25'S, 151°27'E (AM KS.32169). **Queensland:** 1 male, Atherton Tableland, Rose Gums Wilderness Retreat, 12.4 km ENE Malanda, 17°18'51"S, 145°42'9"E (NHMD); 1 male, same locality (NHMD 12203); 3 females, Bakers Blue Mountain, 17 km W Mt Molloy, 16°42'S, 145°10'E (QM S34081); 1 female, Binna Burra, Lamington National Park, 28°12'S, 153°11'E (QM S39724); 1 female, Boombana National Park, 27°24'S, 152°47'E (QM S54579); 1 male, Broken River, Eungella, 19°28'S, 144°45'E (QM S47125); 1 female, Brooyar, Wrattens Camp Road, 26°9'S, 152°31'E (QM S39771); 3 females, 1 juv., Cooloola State Forest, 26°12'S, 153°03'E (QM S33410); 1 male, 1 female, Cooloola, 26°12'S, 153°03'E (QM S33499); 1 female, Eungella National Park, 21°10'S, 148°30'E (QM S69648); 1 male, Eungella National Park, Clark Ranges, 20°35'S, 148°15'E (QM S49159); 1 male, Fraser Island, 25°33'S, 152°59'E (AM KS.32982); 1 male, Hann Tableland, northern end, 16°49'S, 145°11'E (QM S116634); 2 males, 1 female, same locality (QM S116637); 1 male, same locality (QM S40539); 1 male, 1 female, Kirrama Range, Douglas Creek Road, 18°12'S, 145°45'E (QM); 1 female, Kondalilla National Park, 26°40'S, 152°52'E (QM S39764); 10 females, Kroombit Tops, 24°22'S, 151°01'E (QM); 6 females, same locality (QM S116636); 1 female, same locality (QM); 1 female, Kroombit Tops, Beauty Spot 98, 24°22'S, 151°01'E (QM); 1 female, Kroombit Tops, Kroombit Crossing, 24°22'S, 151°01'E (QM); 1 female, Kroombit Tops, Lower Dry Creek, 24°24'S, 151°01'E (QM); 4 females, Kroombit Tops, Three Moon Creek, 24°22'S, 151°01'E (QM); 1 female, Kroombit Tops, Upper Kroombit Creek, 24°25'S, 151°03'E (QM); 1 female, same locality (QM); 1 female, same locality (QM); 1 female, Kuranda, 16°49'S, 145°38'E (MV K10334); 1 female, same locality (AM KS.86178); 1 male, 2 females, Mt Abbott, 20°06'S, 147°45'E (QM); 1 female, Mt Aberdeen, 20°12'S, 147°55'E (QM S38553); 1 male, Mt Archer, 0.5 km WNW, 23°30'S, 150°34'E (QM S80559); 1 male, 1 female, Mt Blackwood, 21°02'S, 148°57'E (QM S116638); 1 female, Mt Blackwood National Park, 21°02'S, 148°57'E (QM S39726); 3 females, Mt Cleveland, summit, 19°16'S, 147°01'E (QM S17879); 1 female, Mt Elliot National Park, 19°29'S, 146°58'E (QM); 1 male, Mt Goonaneman, near Childers, 25°26'S, 152°07'E (QM S116635); 1 female, Mt Tamborine National Park, Joalah section, 27°55'33"S, 153°10'48"E (NHMD 12196); 1 female, Mt Tamborine National Park, Witches Falls, 27°56'27"S, 153°10'48"E (NHMD 12204); 2 females, same locality (NHMD 12199);1 male, Nangur State Forest, 26°08'S, 151°59'E (QM S47836); 1 female, Mooloolah River National Park, Jowarra Section, 26°46'S, 153°02'E (QM S48888); 1 female, Stony Creek 26°56'S, 152°42'E (QM S48955); 1 female, Upper Brookfield, 27°30'S, 152°55'E (QM); 1 female, same locality (QM); 1 female, same locality (QM); 1 female, same locality (QM); 1 female, same locality (QM); 1 female, same locality (QM S56818); 1 female, same locality (QM S39729); 1 female, same locality (QM S39725); 1 female, same locality (QM S39727); 1 female, same locality (QM); 1 female, same locality (QM); 1 female, same locality (QM); 1 female, same locality (QM); 1 female, 2 juv., same locality (QM); 1 female, same locality (QM S69649); 1 female, same locality (QM); 1 female, same locality (QM); 1 female, same locality (QM); 1 female, Wallaman Falls Road junction, 18°39'S, 145°52'E (QM S43284); 2 males, Wongabel, 8 km S Atherton, 17°20'S, 145°29'E (AM KS.29799); 1 male, same locality (AM KS.27931); 1 female, Yungaburra, 17°16'S, 145°35'E (QM); 1 male, same locality (AM KS.34150).

Diagnosis. *L. folium* sp. nov. is most similar to *L. dimidiata* comb. nov. based on somatic and gentialic morphology, but both species are readily separated by their abdominal colouration, specifically the shape of the black shoulder patches and their continuation into black lateral lines. Both form an acute internal angle in *L. folium* sp. nov. (Figs 12A, 13 – arrows), but an obtuse angle in *L. dimidiata* comb. nov. (Figs 7A, 8A – arrows). Male pedipalp morphology differs subtly in some key sclerites; for example, the terminal apophysis of *L. folium* sp. nov. lacks the sclerotised tip of *L. dimidiata* comb. nov. (Fig. 12D vs Fig. 7D), the conductor is less prominent and less elongated and the spine in the basal arch of the median apophysis is comparatively smaller (Fig. 12C vs Fig. 7C). The base of the scape of the female epigyne protrudes less anteriorly in *L. folium* sp. nov. than in *L. dimidiata* comb. nov. (Fig. 13C vs Fig. 8C).

Description. Male (based on holotype; QM S111932). Total length 4.5. ***Carapace*** (Fig. 12A) 2.2 long, 1.7 wide; brown with somewhat darker lateral flanks; few white setae mainly in cephalic area; fovea indistinct broad depression. ***Eyes*:** AME 0.18, ALE 0.14, PME 0.14, PLE 0.13; row of eyes: AME 0.43, PME 0.32, PLE 0.95. ***Sternum*** (Fig. 12B) 1.0 long, 0.8 wide; yellowish-brown; dark grey

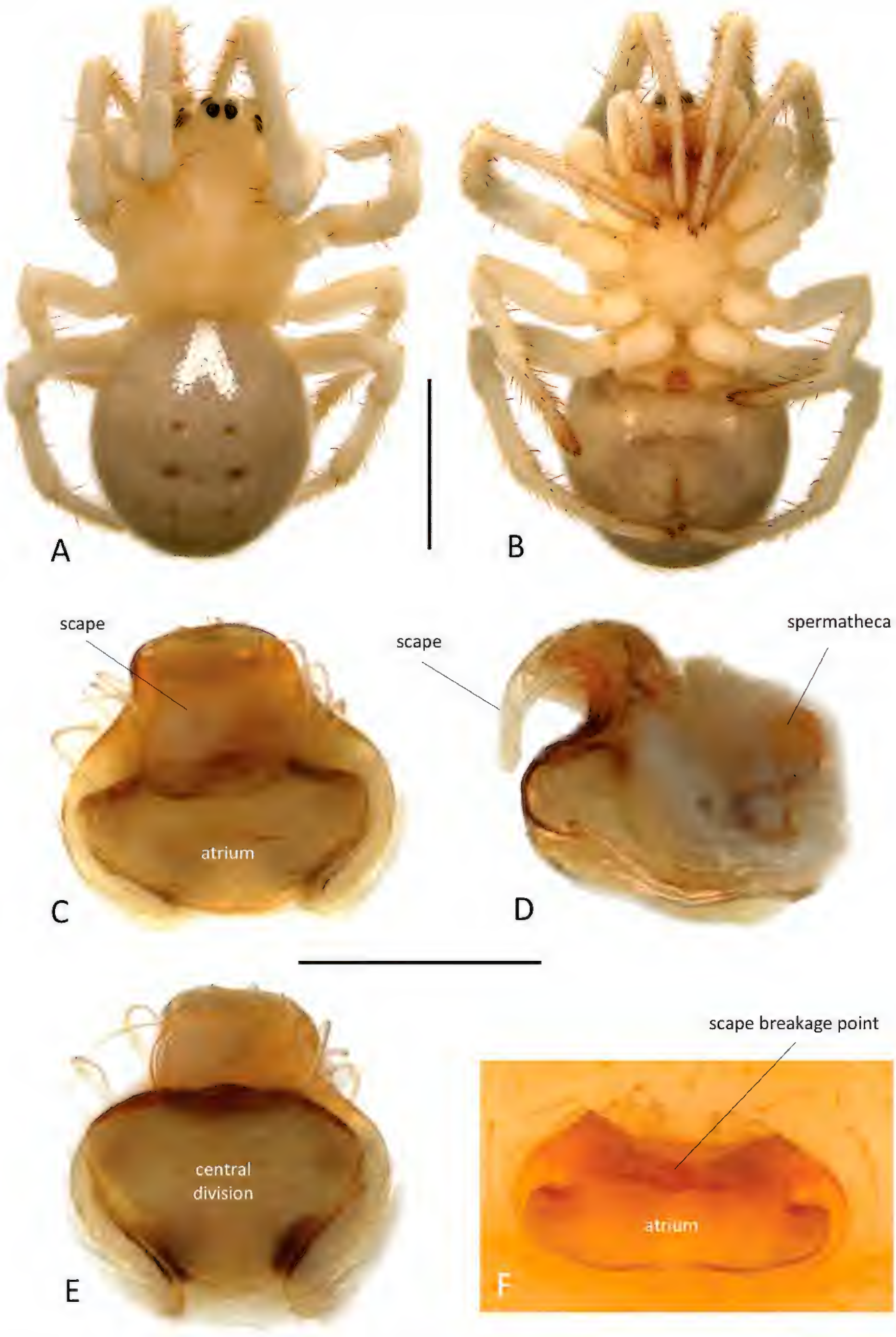


Figure 11. *Leviana cincinnata* sp. nov., female (**A–E** QM S111931; **F** NHMD 12202). **A.** Habitus, dorsal view; **B.** Habitus, ventral view; **C.** Epigyne, ventral view; **D.** Epigyne, lateral view; **E.** Epigyne, posterior view; **F.** Epigyne, ventral view. Scale bars: 2 mm (**A, B**); 0.2 mm (**C, D**).

pigmentation towards margins; covered with few white setae; few brown bristles marginally. ***Labium*** 0.31 long, 0.47 wide; dark reddish-brown. ***Maxillae*** yellow-brown. Chelicerae brown; few white setae in basal half; four promarginal teeth, with the apical and third one largest; three retromarginal teeth of similar size. ***Legs*:** leg formula I > II > IV > III; yellowish-grey; lengths of segments (femur + patella + tibia + metatarsus + tarsus = total leg length): pedipalp 0.6 + 0.2 + 0.2 + – + 0.6 = 1.6, I 2.4 + 1.0 + 2.3 + 2.1 + 0.9 = 8.7, II 2.0 + 0.9 + 1.7 + 1.8 + 0.7 = 7.1, III 1.2 + 0.6 + 0.7 + 0.7 + 0.5 = 3.7, IV 1.6 + 0.8 + 1.3 + 1.3 + 0.6 = 5.6. ***Abdomen*** (Figs 12A, B) 2.4 long, 1.8 wide; elongate ovoid; dorsally yellow-grey with dark folium pattern; four pairs of dark brown sigilla centrally; covered with long brown bristles and white setae; venter centrally dark grey with two elongated guanine patches laterally, covered with brown setae; spinnerets light brown.

Pedipalps (Figs 12C, D): median apophysis apically broadly lobed, basally with thorn opposing a hooded base; terminal apophysis fleshy, elongated with double-tip; embolus with broad base and short tip; conductor stout.

Female (QM S111922; epigyne variation QM S116638). Total length 7.1. ***Carapace*** (Figs 13A) 3.0 long, 2.3 wide; brown somewhat darker laterally; white setae in particular in cephalic area; fovea shallow and poorly demarcated. ***Eyes*:** AME 0.23, ALE 0.13, PME 0.18, PLE 0.13; row of eyes: AME 0.54, PME 0.43, PLE 1.40. ***Sternum*** (Fig. 13B) 1.4 long, 1.1 wide; brown; dark grey to black pigmentation towards margins; covered with few white setae; few long brown bristles marginally. ***Labium*** 0.45 long, 0.65 wide, dark brown. ***Maxillae*** dark brown. Chelicerae dark brown; few white setae in basal half, few black setae mesally in apical half; four promarginal teeth, with the apical and third one largest; three retromarginal teeth of similar size. ***Legs*:** leg formula I > II > IV > III; brown with indistinct darker annulations, mainly on tibiae and metatarsi of leg III and IV; lengths of segments (femur + patella + tibia + metatarsus + tarsus = total length of leg): pedipalp 0.8 + 0.3 + 0.4 + – + 0.8 = 2.3, I 2.5 + 1.1 + 2.0 + 1.8 + 1.0 = 8.4, II 2.1 + 1.0 + 1.6 + 1.7 + 0.8 = 7.52, III 1.9 + 0.7 + 1.0 + 0.9 + 0.6 = 5.1, IV 2.3 + 1.0 + 1.5 + 1.5 + 0.7 = 7.0. ***Abdomen*** (Fig.13A, B) 4.8 long, 3.8 wide; ovoid, slightly dorsoventrally compressed; dorsal colour pattern and setae largely as male, but dorsal pattern less distinct; venter as male, but centrally darker; spinnerets brown.

Epigyne (Fig. 13C–F) wider than long, ovoid; atrium elevated, bulging; central division broadly oval with narrow base; scape short, almost translucent, straight in lateral view; broken off anteriorly in most specimens (e.g. Fig. 13F).

Variation. Males total length 3.9–5.1 (n = 8), females 4.9–7.9 (n = 10). Colour variations of this species include, particularly in females, a distinct dark posterior patch that is sometimes poorly defined and sometimes distinctly demarcated. The epigyne scape was broken off in nine of the ten specimens measured.

Life history and habitat preferences. Mature female *L. folium* sp. nov. were found throughout the year with the exception of July and August and peak numbers were recorded between December and April. Two females with eggsacs were collected in January and March. Males were collected between October and April (with a single record from the NT in June). This species therefore is spring- to summer mature.

Most specimens of *L. folium* sp. nov. were found in rainforest, but some specimen labels list 'open forest' and 'vine scrub' as habitat.

Distribution. *Leviana folium* sp. nov. has been found in Queensland and New South Wales between ca. 16°45'S and 34°45'S Latitude, generally on the eastern slopes of the Great Dividing Range (Fig. 14).

Leviana minima sp. nov.

https://zoobank.org/FD348479-8703-46B5-A5A8-F23032B044F2

Figs 14, 15A–D, 16A–E

Type material. ***Holotype*** male, Thornton Peak, N of Daintree (16°10'S, 145°22'E, Queensland, Australia), rainforest site 39, 610 m, November 1975, M. Gray, foliage (AM KS.131102).

Etymology. The specific epithet is an adjective in apposition (*minimus*, Latin – smallest) and refers to the small size of the species in comparison to all other *Leviana* gen. nov. species.

Other material examined. Australia: **Queensland:** 1 male, 1 female, Atherton Tableland, Rose Gums, 17°18'44"S, 145°42'9"E (NHMD 12189); 1 female, Bellenden Ker, 17°16'S, 145°51'E (QM S26350); 9 males, 5 females, 19 juv., same locality (QM S27694); 3 males, 8 females, 6 juv., Bellenden Ker Range, 17°16'S, 145°51'E (QM); 1 female, same locality (QM); 2 males, 1 female, 3 juv., Bellenden Ker, summit, 17°15'53"S, 145°51'29"E (QM S59262); 1 female, Cape Tribulation, 3 km W, 16°05'S, 145°28'E (QM); 2 males, 14 females, 3 juv., Cape Tribulation, 4.5–5km W, 16°05'S, 145°28'E (QM); 1 female, same locality (QM); 2 females, Cape Tribulation, 5 km W, 16°05'S, 145°28'E (QM); 1 male, Carbine Tableland, Devils Thumb, 16°23'48"S, 145°17'38"E (QM S29997); 3 females, 1 juv., Carbine Tableland, Devils Thumb, 16°23'48"S, 145°17'38"E (QM); 1 female, 1 juv., same locality (QM S29996); 1 male, same locality (QM S29987); 1 male, Cardwell Range, Upper Broadwater Creek Valley, 18°18'S, 145°56'E (QM); 1 male, same locality (QM); 1 male, 5 females, Chujeba Peak, 16°56'S, 145°39'E (QM S41534); 10 females, same locality (QM S41587); 4 females, same locality (QM S33587); 1 male, same locality (QM S41586); 3 females, Devils Thumb, 16°24'S, 145°18'E (QM); 1 female, Isley Hills, 17°02'52"S, 145°41'25"E (QM S58223); 1 female, Kirrama Range, Douglas Creek Road, 18°12'S, 145°45'E (QM); 2 males, 2 females, 1 juv., same locality (QM); 4 females, Lambs Head, 10 km W Edmonton, 17°02'S, 145°38'E (QM S41512); 1 female, same locality (QM S69379); 1 female, 3 juv., Malaan State Forest, 17°35'30"S, 145°36'45"E (QM); 1 female, Massey Range, 4 km W of Bellenden Ker,

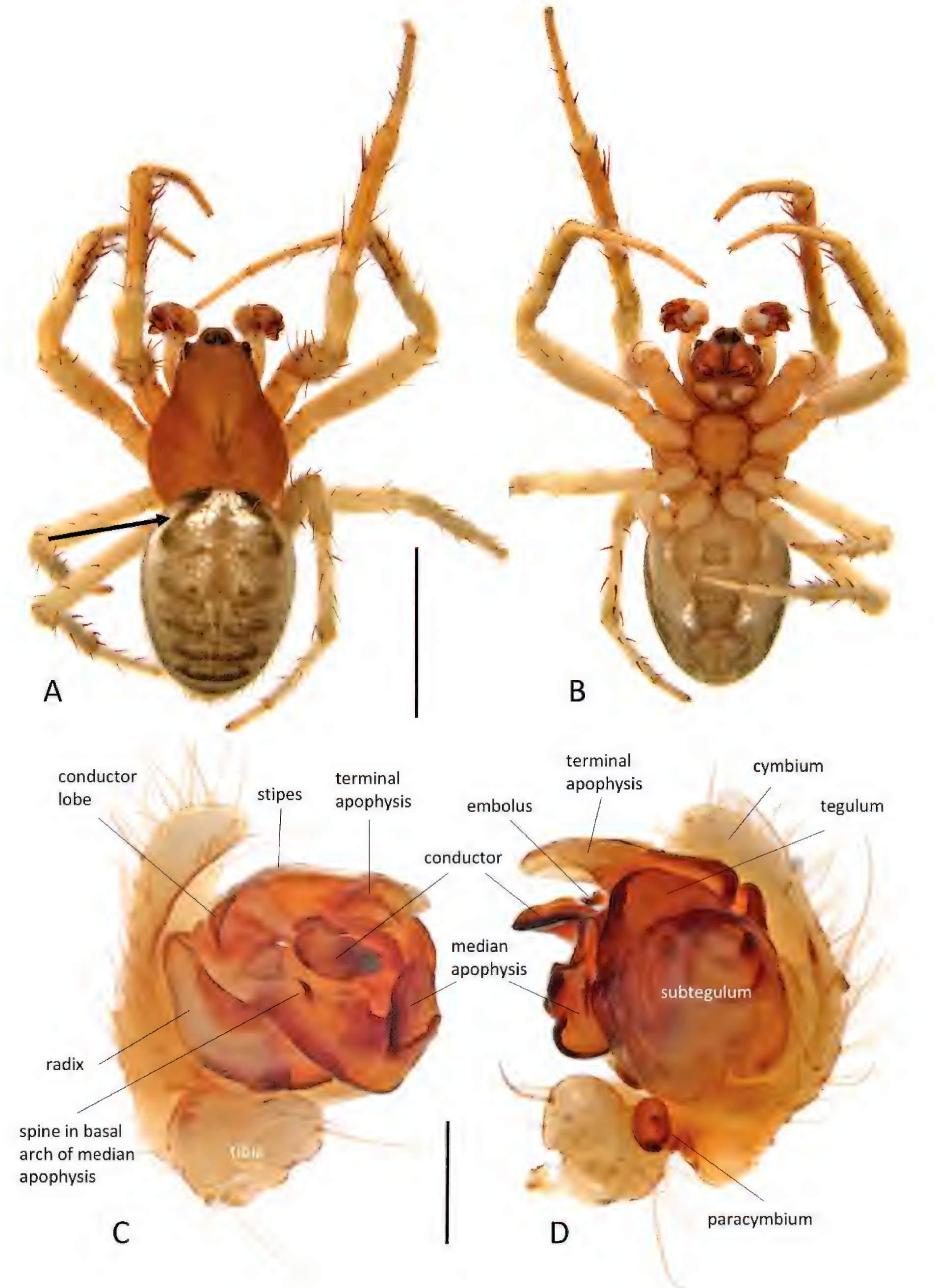


Figure 12. *Leviana folium* sp. nov., male holotype (QM S111932). **A.** Habitus, dorsal view; **B.** Habitus, ventral view; **C.** Left male pedipalp, ventral view; left male pedipalp, dorsal view. Scale bars: 2 mm (**A, B**); 0.2 mm (**C, D**). Arrow in (**A**) points to diagnostic character distinguishing *L. folium* sp. nov. and *L. dimidiata* comb. nov.

17°15'45"S, 145°49'06"E (QM S59006); 12 males, 23 females, 6 juv., same locality (QM S80636); 1 female, Mossman Bluff Track, 5–10 km W Mossman, 16°28'S, 145°22'E (QM S33943); 1 female, Mossman, 11 km NW, near Plane Crash, 16°23'S, 145°17'E (QM S46822); 1 female, same locality (QM S25201); 1 female, Mt Bartle Frere, 17°23'S, 145°47'E (QM S75226); 1 male, same locality (QM); 1 female, same locality (QM); 8 males, 9 females, 5 juv., same locality (QM); 5 females, 1 juv., Mt Demi, summit, 7 km SW Mossman, 16°30'S, 145°19'E (QM S38179); 1 male, 2 females, 2 juv., Mt Fisher, 17°32'S, 145°33'E (QM); 2 females, 1 juv., same locality (QM); 1 male, same locality (QM S38148); 2 males, 2 females, Mt Fisher, Kjellberg Road, 17°32'S, 145°33'E (QM S46411); 3 females, same locality (QM S38143); 1 male, Mt Haig, 17°06'S, 145°36'E (QM S31456); 1 female, 2 juv., Mt Halcyon, 16°03'S, 145°25'E (QM S58261); 3 females, Mt Halcyon, summit, 16°03'16"S, 145°25'16"E (QM S58257); 1 female, same locality (QM S38634); 2 males, same locality (QM S38657); 1 male, 3 females, Mt Halifax, 19°07'S, 146°23'E (QM S17946); 7 males, 5 females, 5 juv., Mt Halifax, SE ridge, 19°07'S, 146°23'E (QM S17954); 1 male, Mt Hemmant, 16°07'S, 145°25'E (QM S41146); 1 male, Mt Hugh Nelson, SE shoulder, 17°30'05"S, 145°33'15"E (QM S59804); 2 females, Mt Kooroomool, summit, 7 km S, 17°54'S, 145°41'E (QM S47301); 1 female, Mt Lewis, 5.5 km N of, 16°35'S, 145°17'E (QM); 1 male, Mt Pieter-Botte, 16°04'S, 145°24'E (QM S32468); 1 male, Mt Sorrow summit, Cape Tribulation, 16°06'S, 145°26'E (QM); 4 females, Mt Williams, summit, 16°55'S, 145°40'E (QM); 1 female, Paluma Township, 19°00'S, 146°13'E (QM S59068); 4 males, same locality (QM S59066); 1 male, Roaring Meg Valley, 16°04'S, 145°25'E (QM S58277); 2 females, Roots and Saltwater Creeks Divide, via Mossman, 16°25'S, 145°16'E (QM S35959); 1 male, 6 females, Stewart Creek, 4 km NNE Mt Spurgeon, 16°24'19"S, 145°13'01"E (QM); 1 female, The Crater National Park, tower nearby, 17°27'S, 145°29'E (QM S38225); 2 females, 1 juv., Thornton Peak, 16°10'S, 145°22'E (QM); 8 females, 1 juv., Thornton Peak, 16°10'S, 145°22'E (QM); 3 females, same locality (QM); 2 males, 7 females, same locality (QM); 1 male, 7 females, same locality (QM); 1 male, 5 females, 3 juv., Thornton Peak, 11 km NE Daintree, 16°10'S, 145°22'E (QM); 11 females, 5 juv., Thornton Peak, N of Daintree, 16°10'S, 145°22'E (AM KS.600); 4 males, 11 females, 17 juv., Thornton Peak, N of Daintree, 16°10'S, 145°22'E (AM KS.498); 1 female, same locality (AM KS131103); 1 female, same locality (AM KS131104); 3 males, 16 females, 20 juv., same locality (AM KS.550); 1 male, 4 females, 1 juv., Upper Boulder Creek, 17°50'S, 145°54'E (QM); 1 female, Upper Boulder Creek Valley, 17°50'S, 145°54'E (QM); 2 males, 2 females, Upper Boulder Creek, 11 km NW Tully, 17°50'S, 145°54'E (QM); 1 female, Upper Boulder Creek, via Tully, 17°50'S, 145°54'E (QM); 2 females, Walter Hill Range, 17°47'S, 145°49'E (QM S41138); 1 male, same locality (QM S41113); 1 male, Windsor Tableland, 16°12'S, 145°05'E (QM).

Diagnosis. *Leviana minima* sp. nov. is the smallest of all species in the genus with all specimens 3 mm or less in total length. In contrast, no other *Leviana* gen. nov. specimen was measured less than 3.5 mm. The median apophysis of the male pedipalp is morphologically closest to *L. mulieraria* comb. nov., as it is not broadly lobed apically, but somewhat tapers into a round tip; however, it is narrower in *L. mulieraria* comb. nov. than in *L. minima* sp. nov. (Fig. 15 vs Fig. 17A). Similarly, the epigyne of *L. minima* sp. nov. is most similar to that of *L. mulieraria* comb. nov. as the atrium of both is not bulging and has distinct, narrow lateral ridges (Fig. 16C, D vs Fig. 18C). However, the lateral edges of the epigyne are much more protruding in posterior view in *L. minima* sp. nov. than in *L. mulieraria* comb. nov. (Fig. 16E vs Fig. 18D).

Description. Male (based on holotype; AM KS.131102). Total length 2.0. ***Carapace*** (Fig. 15A) 1.1 long, 0.9 wide; uniformly light brown, centrally somewhat lighter posterior of cephalic area; few brown setae centrally; fovea indistinct elongate depression. ***Eyes*:** AME 0.09, ALE 0.05, PME 0.08, PLE 0.05; row of eyes: AME 0.23, PME 0.22, PLE 0.49. ***Sternum*** (Fig. 15B) 0.5 long, 0.4 wide, yellowish-brown; dark grey pigmentation towards margins; few brown setae in anterior half. ***Labium*** 0.18 long, 0.11 wide; yellow-brown. ***Maxillae*** yellow-brown with dark pigmentation laterally. Chelicerae yellowish-brown; three retromarginal teeth of equal size, three promarginal teeth with the median largest. ***Legs*:** leg formula I > II > IV > III; light brown with some grey pigmentation and comparatively long, distinct setae, specifically on legs I and II; lengths of segments (femur + patella + tibia + metatarsus + tarsus = total leg length): pedipalp 0.2 + 0.1 + 0.1 + – + 0.3 = 0.7, I 1.1 + 0.5 + 0.8 + 0.8 + 0.4 = 3.6, II 0.9 + 0.4 + 0.7 +0.7 + 0.4 = 3.0, III 0.5 + 0.2 + 0.3 + 0.3 + 0.1 = 1.5, IV 0.7 + 0.2 + 0.5 + 0.5 + 0.3 = 2.2. ***Abdomen*** (Fig. 15A, B) 1.1 long, 1.1 wide; ovoid; dorsally olive-grey but centrally lighter; covered with long light brown bristles; venter centrally olive grey lighter spots laterally, few brown setae; spinnerets olive brown.

Pedipalps (Fig. 15C, D): median apophysis apically tapering into a rounded tip, basally with short spine in arch; terminal apophysis stout and sclerotised; embolus with short tip but hidden behind conductor in ventral view; conductor asymmetrically T-shaped.

Female (based on AM KS.131103; epigyne variation AM KS.131104). Total length 2.5. ***Carapace*** (Fig. 16A) 1.2 long, 1.0 wide; light brown laterally with some grey pigmentation, centrally somewhat lighter; fovea shallow and poorly demarcated. ***Eyes*:** AME 0.11, ALE 0.05, PME 0.09, PLE 0.05; row of eyes: AME 0.27, PME 0.18, PLE 0.58. ***Sternum*** (Fig. 16B) 0.6 long, 0.5 wide; yellowish-brown; faint grey pigmentation towards margins; few brown setae mainly in anterior half. ***Labium*** 0.14 long, 0.25 wide, colouration as male. ***Maxillae*** as male. Chelicerae yellowish-brown; frontally with dark grey pigmentation in basal half; three promarginal teeth, with the median largest; three retromarginal teeth of similar size. ***Legs*:** leg formula I > II > IV > III; light brown

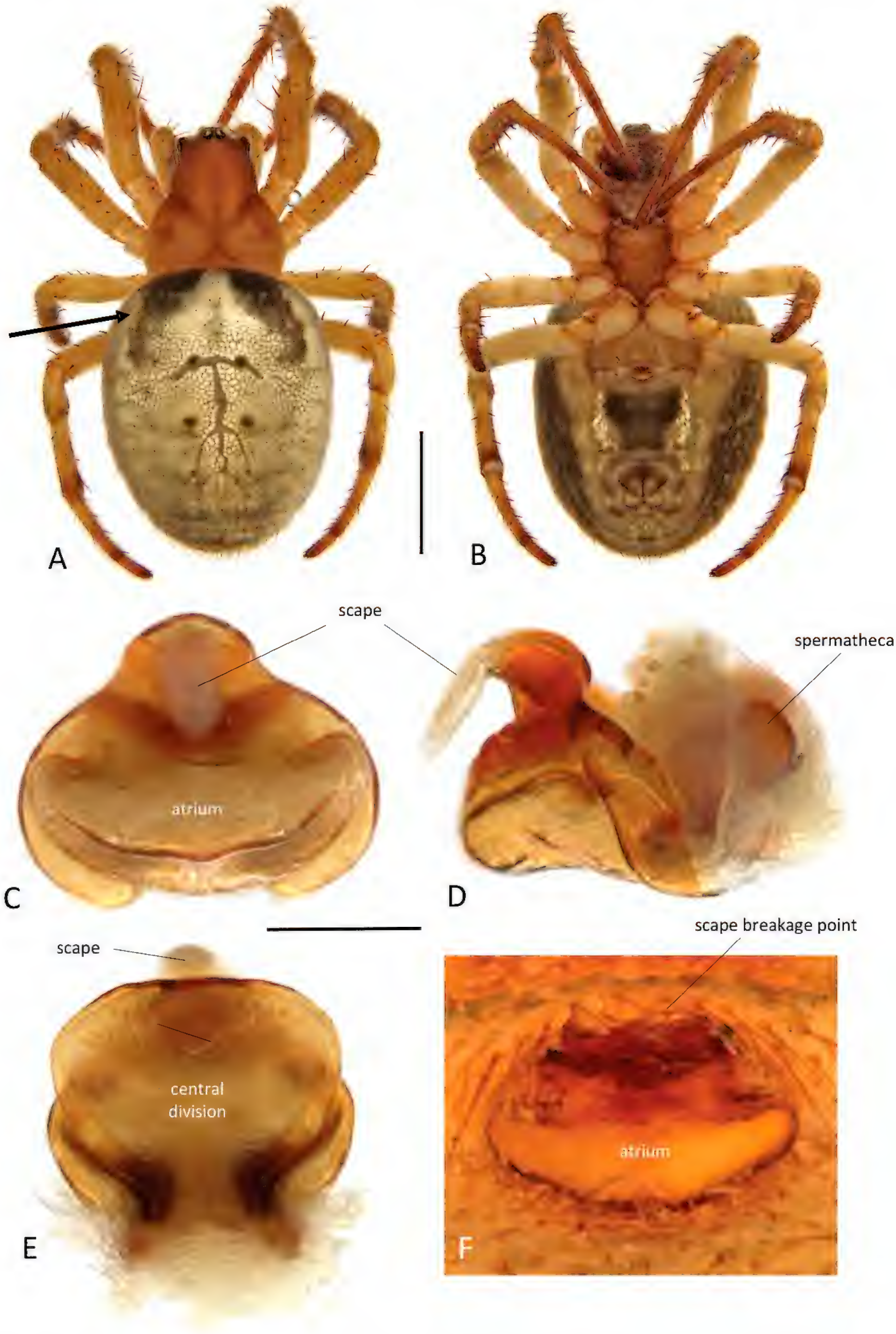


Figure 13. *Leviana folium* sp. nov., female (**A, B, F** QM S111922; **C–E** QM S116638). **A.** Habitus, dorsal view; **B.** Habitus, ventral view; **C.** Epigyne, ventral view; **D.** Epigyne, lateral view; **E.** Epigyne, posterior view; **F.** Epigyne, ventral view. Scale bars: 2 mm (**A, B**); 0.1 mm (**C, D**). Arrow in (**A**) points to diagnostic character distinguishing *L. folium* sp. nov. and *L. dimidiata* comb. nov.

with some dark pigmentation, specifically apically on all femora and tibiae; metatarsi and tarsi darker; lengths of segments (femur + patella + tibia + metatarsus + tarsus = total length of leg): pedipalp 0.3 + 0.1 + 0.2 + – + 0.4 = 1.0, I 1.2 + 0.4 + 0.9 + 0.9 + 0.5 = 3.8, II 1.1 + 0.5 + 0.8 + 0.8 + 0.4 = 3.56, III 0.7 + 0.3 + 0.4 + 0.4 + 0.3 = 2.1, IV 1.0 + 0.4 + 0.6 + 0.7 + 0.4 = 2.9. ***Abdomen*** (Fig. 16A, B) 1.6 long, 1.5 wide; ovoid, slightly dorsoventrally compressed; dorsally with dark folium pattern that is lighter centrally, particularly in anterior half with large white guanine patches; venter as male; spinnerets olive-brown.

Epigyne (Fig. 16C–F); wider than long, laterally with semicircular narrow rims; scape triangular with rounded tip; broken off half-way in most specimens (Fig. 14D); lateral borders of epigyne protruding laterally in posterior view (Fig. 16E).

Variation. Males total length 1.8–2.1 (n = 4), females 2.0–3.0 (n = 12). Colour variations of this species mainly occur on the abdomen, where the folium pattern can be more or less distinct. The scape was broken off in all but two of the 12 females measured.

Life history and habitat preferences. Mature females of *L. minima* sp. nov. have been found between October and June, and mature males between October and May. Curiously, no females were found in February and no males in January, indicating that there may be two reproductive periods throughout the year, one in spring and one in late summer.

Many of the specimens of *L. minim*a sp, nov. were collected at altitudes from altitudes higher than 800 m, suggesting a preference for mountainous regions. Here the spiders have been largely found in rainforest. In contrast to other species of *Leviana* gen. nov., there are no records of *L. minima* sp. nov. that describe leaf-curling behaviour.

Distribution. *Leviana minima* sp. nov. has only beeн found in northern coastal Queensland between ca. 16°S and 19°S Latitude (Fig. 14).

Leviana mulieraria (Keyserling, 1887) comb. nov.

Figs 14, 17A–D, 18A–D

Epeira mulieraria Keyserling 1887: 200–201, plate 18, figs 1, 1a.

Aranea mulieraria (Keyserling).- Roewer 1942: 830.

Araneus mulierarius (Keyserling).- Rainbow 1911: 189; Bonnet 1955: 547.

Type material. ***Holotype*** of *Epeira mulieraria* Keyserling, 1887: male, Cape York (ca. 10°41'S, 142°31'E, Queensland, Australia), Bradley Collection (considered lost; Framenau 2005)) (not examined).

Other material examined. Australia: **Northern Territory:** 3 females, 3 juv., Amphitheatre Crystal Falls, Nitmiluk National Park, 14°19'S, 132°34'E (QM S37914); 1 male, 1 juv., Darwin, 12°27'S, 130°50'E (MV K-10353); 2 female, Groote Eylandt, 13°56'S, 136°36'E (SAM); 1 male, Humpty Doo, Solar Village, 12°35'S,

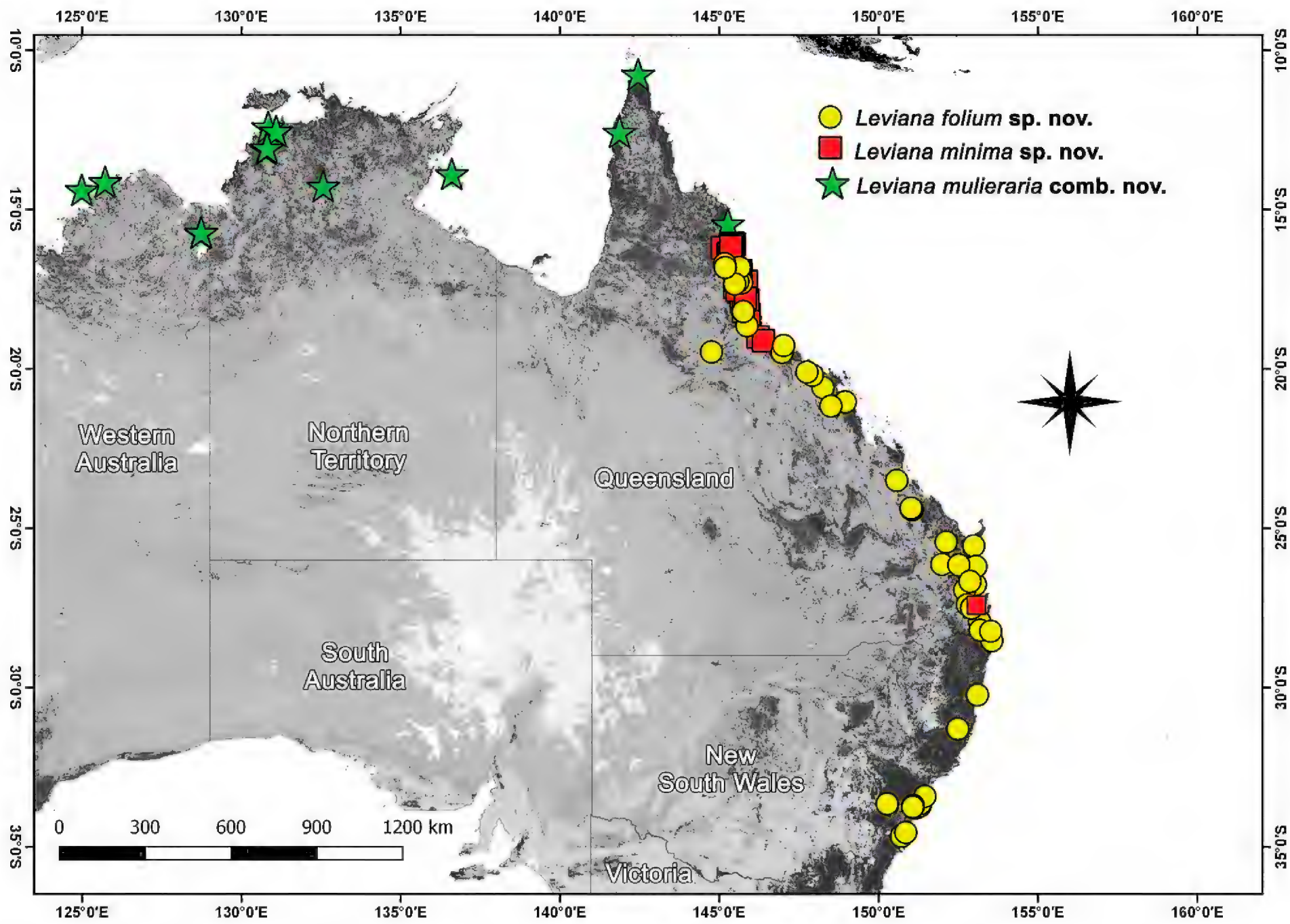


Figure 14. Distribution records of *Leviana folium* sp. nov., *L. minima* sp. nov. and *L. mulieraria* comb. nov.

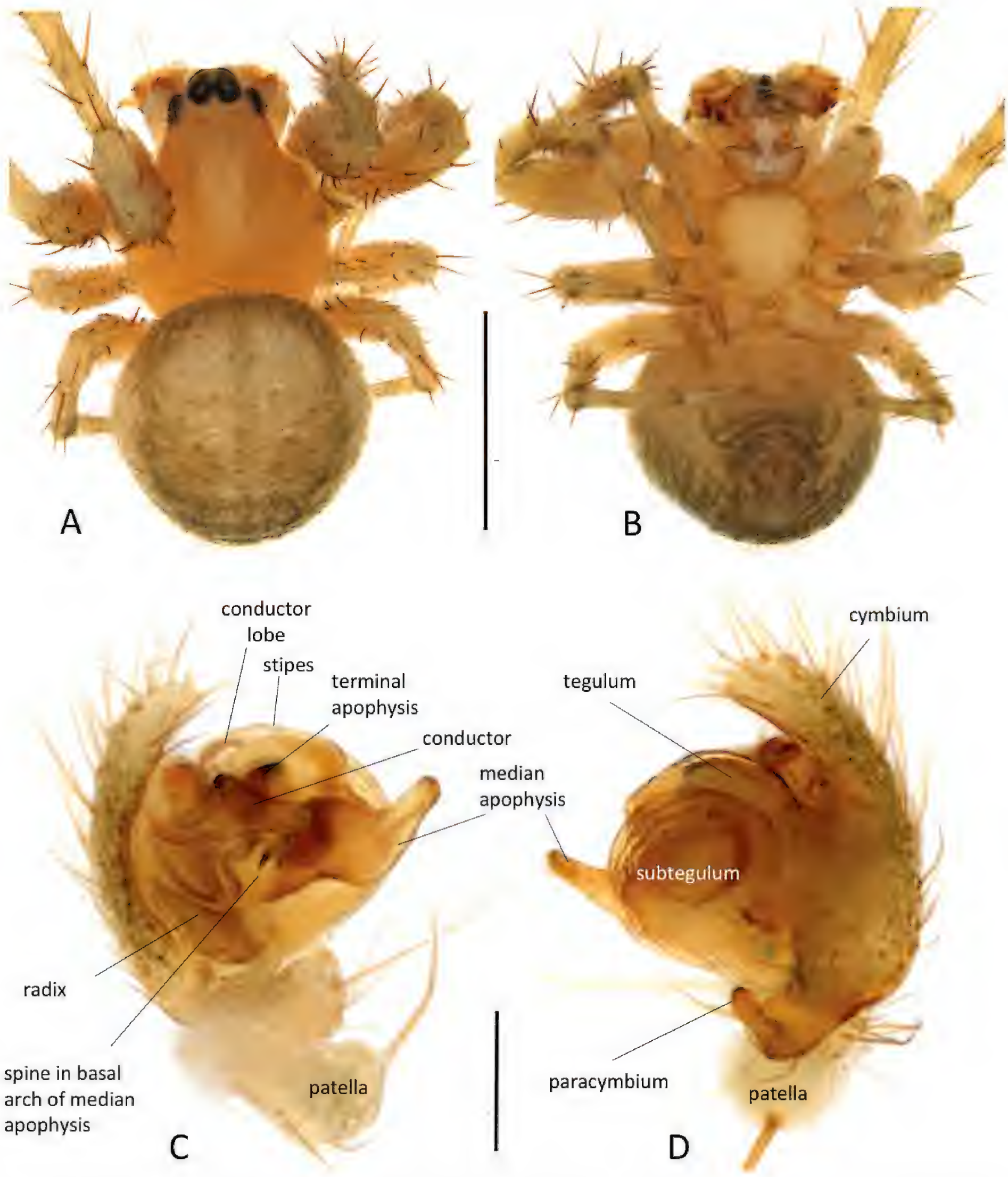


Figure 15. *Leviana minima* sp. nov., male holotype (AM KS.131102). **A.** Habitus, dorsal view; **B.** Habitus, ventral view; **C.** Left male pedipalp, ventral view; left male pedipalp, dorsal view. Scale bars: 1 mm (**A, B**); 0.1 mm (**C, D**).

131°05'E (AM KS.59129); 1 female, Litchfield National Park, 13°07'20"S, 130°48'40"E (AM KS.62728); 1 male, Litchfield National Park, 13°09'S, 130°46'E (AM KS.59123). **Queensland:** 1 female, Hibbet Point, Weipa, 12°37'S, 141°52'E (QM S116639); 1 female, Lockerbie, 10°48'S, 142°27'E (QM S39740); 1 male, Mt Cook, 15°30'S, 145°16'E (QM S116640). **Western Australia:** 4 females, 5 juv., Corneille Island, Bonaparte Archipelago, 14°11'20"S, 125°43'56"E (WAM T77420); 1 female, Kununurra, Frank Wise Institute, Agriculture WA, 15°46'S, 128°44'E (WAM T85272); 2 females, 2 juv., Kununurra, Kona Lakeside Caravan Park, 15°47'33"S, 128°43'20"E (WAM T77418); 1 male, same locality (WAM T77419); 1 male, South Meret Island, track above north-east beach, 14°26'S, 124°59'E (WAM T81168).

Diagnosis. *Leviana mulieraria* comb. nov. is unique amongst all *Leviana* gen. nov. species based on the elongate, cylindrical abdomen; all other species have an ovoid,

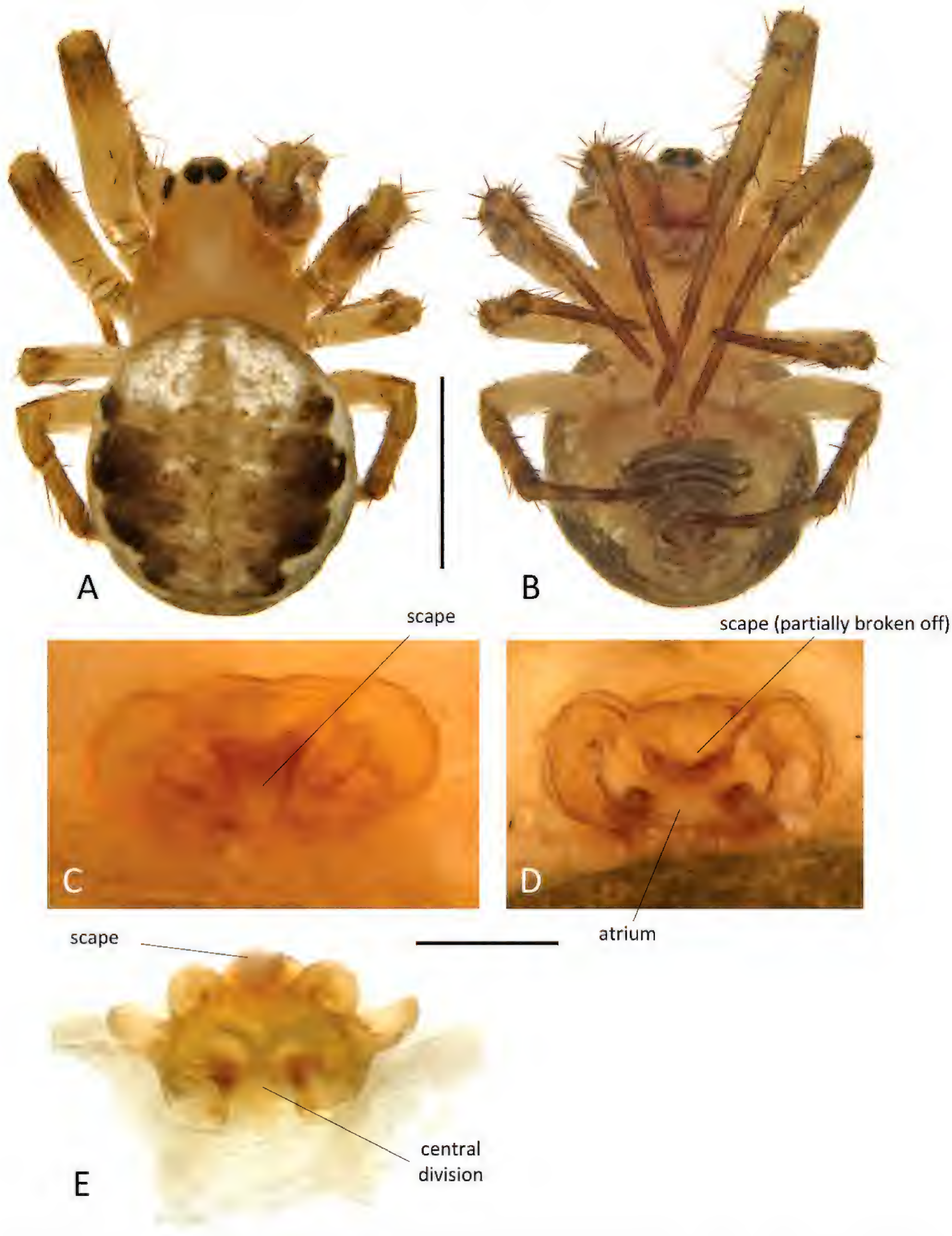


Figure 16. *Leviana minima* sp. nov., female (**A, B, D** AM KS.131103; **C, E** AM KS.131104). **A.** Habitus, dorsal view; **B.** Habitus, ventral view; **C.** Epigyne, ventral view; **D.** Epigyne, ventral view; **E.** Epigyne, posterior view. Scale bars: 1 mm (**A, B**); 0.1 mm (**C, D**).

slightly dorso-ventrally compressed abdomen. Genital morphology is most similar to that of *L. minima* sp. nov., but the median apophysis of the male pedipalp is broader and tapering more apically (Fig. 15C vs Fig. 17C) and the lateral edges of the female epigyne do not protrude as much (Fig. 16E vs Fig. 18D).

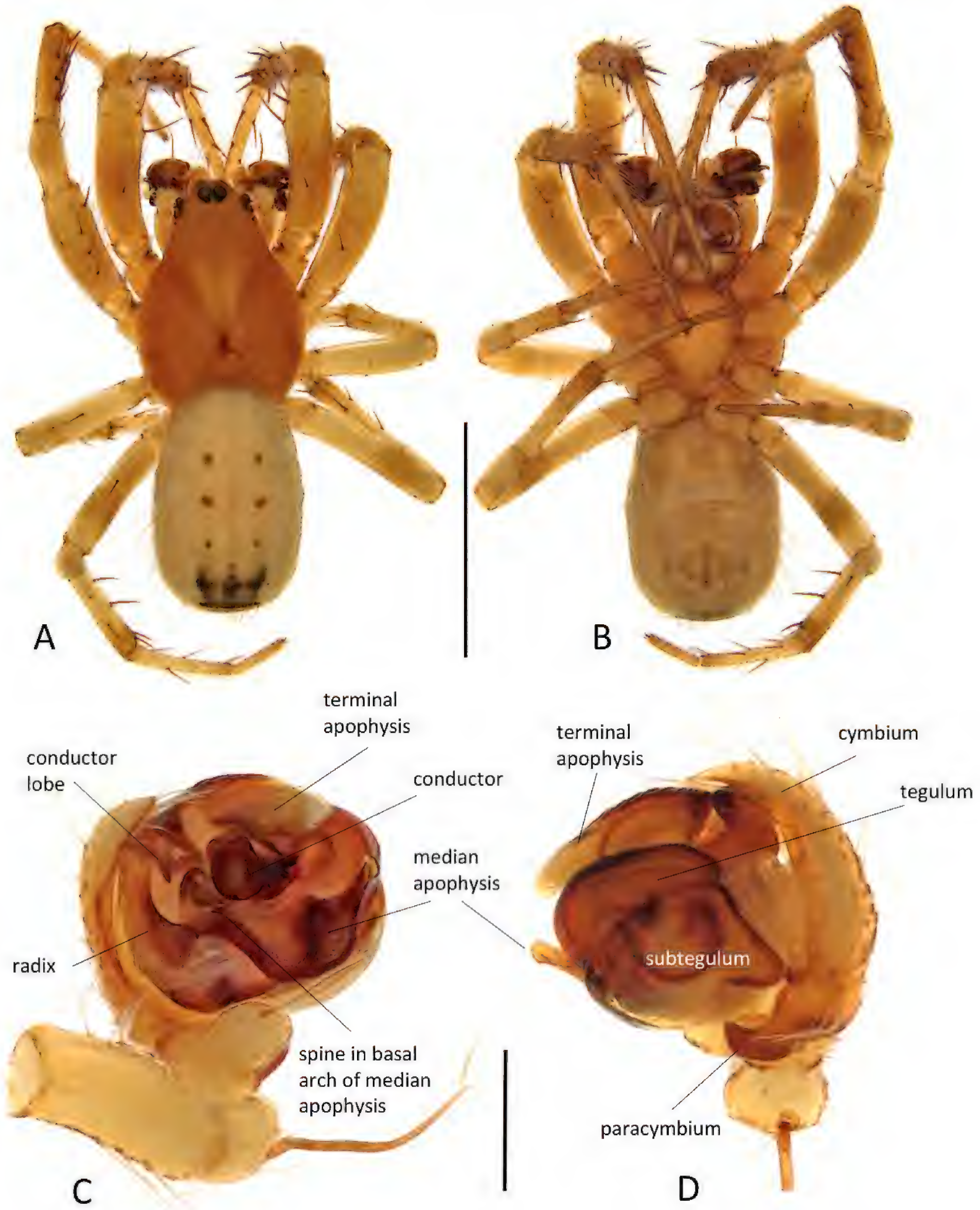


Figure 17. *Leviana mulieraria* comb. nov., male (QM S116640). **A.** Habitus, dorsal view; **B.** Habitus, ventral view; **C.** Left male pedipalp, ventral view; left male pedipalp, dorsal view. Scale bars: 2 mm (**A, B**); 0.2 mm (**C, D**).

Description. Male (QM S116640). Total length 3.6. ***Carapace*** (Fig. 17A) 2.0 long, 1.4 wide; brown, centrally somewhat lighter in posterior cephalic area; fovea indistinct elongate depression. ***Eyes*****:** AME 0.18, ALE 0.11, PME 0.14, PLE 0.11; row of eyes: AME 0.43, PME 0.27, PLE 0.77. ***Sternum*** (Fig. 17B) 0.9 long, 0.7 wide, orange-brown; dark grey pigmentation towards margins; covered with few white setae. ***Labium*** 0.18 long,

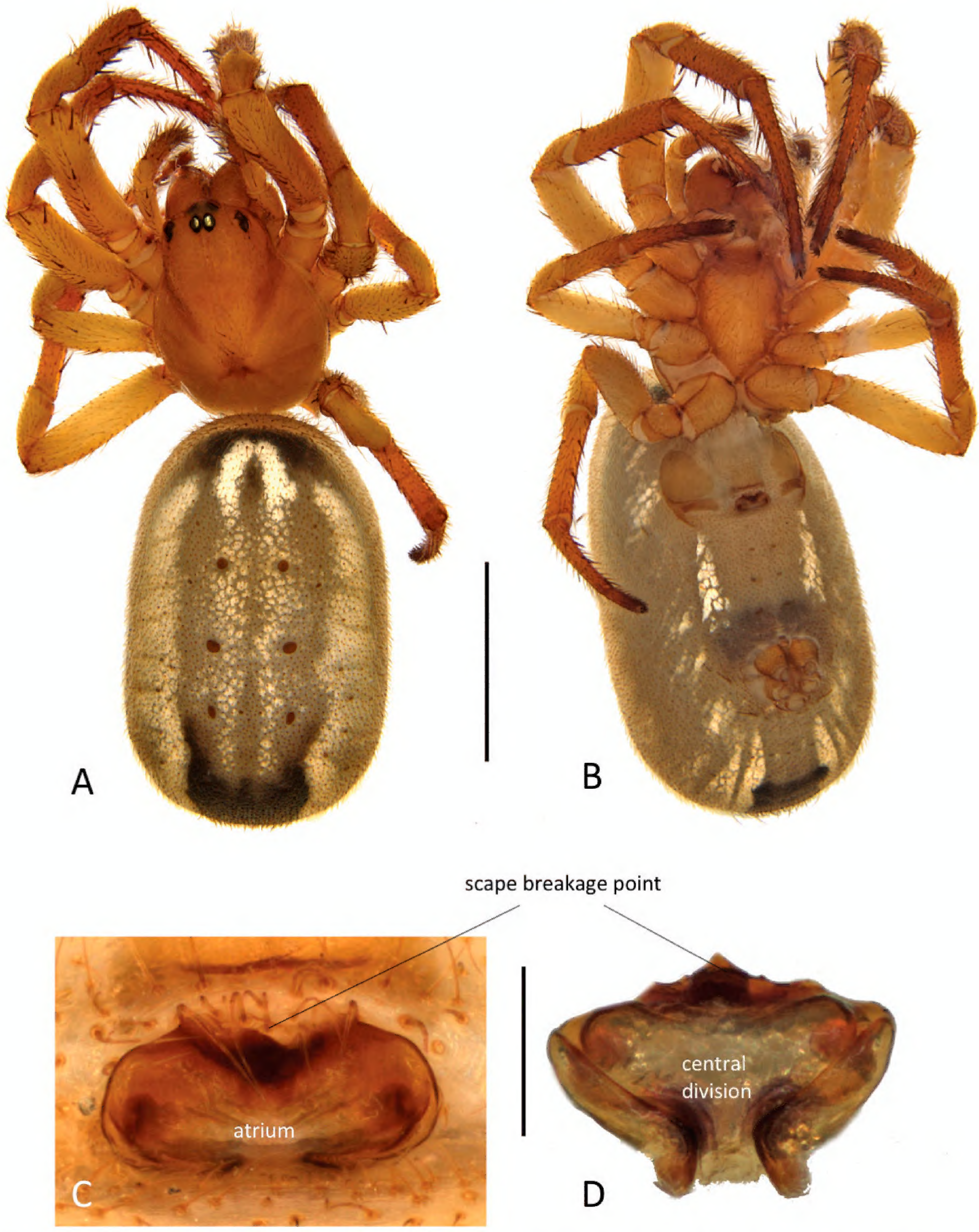


Figure 18. *Leviana mulieraria* comb. nov., female (QM S116639). **A.** Habitus, dorsal view; **B.** Habitus, ventral view; **C.** Epigyne, ventral view; **D.** Epigyne, posterior view. Scale bars: 2 mm (**A, B**); 0.2 mm (**C, D**).

0.32 wide; basally brown. ***Maxillae*** brown. Chelicerae brown; three retromarginal teeth of equal size, three promarginal teeth with the median largest. ***Legs*:** leg formula I > II > IV > III; dark brown with distinct yellow-brown annulations; lengths of segments (femur + patella + tibia + metatarsus + tarsus = total leg length): pedipalp 0.3 + 0.2 + 0.2 + – + 0.4 = 1.1, I 1.5 + 0.8 + 1.4 + 1.2 + 0.6 = 5.5, II 1.4 + 0.7 + 1.1 +1.0 + 0.5 = 4.7, III 1.0 + 0.5 + 0.6 + 0.5 + 0.4 = 3.0, IV 1.2 + 0.6 + 1.0 + 0.8 + 0.5 = 4.1. ***Abdomen*** (Fig. 17A, B) 1.9 long, 1.3 wide; elongate cylindrial;

dorsally yellow-beige, with black irregular, square patch posteriorly; three distinct pairs of dark brown sigilla centrally; venter uniformly beige with few small darker spots.

Pedipalps (Fig. 17C, D): median apophysis broad, apically tapering, basally with spine inside arch; terminal apophysis partially translucent, broadly lobed and with basal spine; embolus short; conductor broad.

Female (based on QM S116639). Total length 6.2. ***Carapace*** (Fig. 18A) 2.4 long, 1.6 wide; brown with indistinct radial darker lines demarcating cephalic area; fovea shallow and poorly demarcated. ***Eyes*:** AME 0.18, ALE 0.11, PME 0.13, PLE 0.11; row of eyes: AME 0.38, PME 0.27, PLE 0.92. ***Sternum*** 1.1 long, 0.9 wide; orange-brown; darker towards margins; brown setae denser toward margin. ***Labium*** 0.36 long, 0.45 wide, brown. ***Maxillae*** as male. Chelicerae brown; few white setae in basal half; four promarginal teeth, with the apical and third one largest; three retromarginal teeth of similar size. ***Legs*:** leg formula I > II > IV > III; femora and patellae yellowish-brown, tibiae, metatarsi and tarsi orange-brown; lengths of segments (femur + patella + tibia + metatarsus + tarsus = total length of leg): pedipalp 0.9 + 0.4 + 0.4 + – + 0.7 = 2.4, I 1.6+1.0 + 1.5 + 1.4 + 0.7 = 6.2, II 1.5 + 0.8 + 1.1 + 1.2 + 0.6 = 5.2, III 1.1 + 0.6 + 0.7 + 0.6 + 0.5 = 3.5, IV 1.5 + 0.8 + 1.1 + 1.1 + 0.6 = 5.1. ***Abdomen*** (Fig. 18A, B) 4.2 long, 2.5 wide; ovoid cylindrical, central band olive-grey turning black posteriorly, anteriorly with two white guanine patches; three distinct pair of brown sigilla; laterally light olive grey; venter olive grey with two white lines laterally; spinnerets brown. ***Epigyne*** (Fig. 18C, D) wider than long; lateral edges semicircular with narrow ridges; shape of scape unknown, broken off in all specimens examined (Fig. 18C); central division tapering into a narrow base (Fig. 18D).

Variation. Males total length 3.6–5.0 (n = 2), females 5.0–7.3 (n = 6). Colour variations of this species mainly relate to the abdomen, where the folium pattern can be more or less distinct (e.g. compare male and female in Figs 17A, 18A). The scape was broken off in all six female specimens measured.

Remarks. The holotype of *Epeira mulieraria*, described from a male of the Bradley collection, appears to be lost (see also Framenau 2005) as it could not be found in any of the historic museum collections in which Keyserling's type material is deposited. However, the unique morphology of this species including its distinct abdominal colouration leave no doubt about the identity of this species and it is not considered necessary to designate a neotype here.

Life history and habitat preferences. Collecting numbers of *L. mulieraria* comb. nov. are too low for an interpretation of its life cycles. Mature females were found from January to March, in May, August and October, mature males in March, May, August and October to November. Adults of this tropical species were therefore collected both in the wet and the dry seasons. Habitat descriptions include rainforest and vine thickets.

Distribution. *Leviana mulieraria* comb. nov. has been found in tropical northern Queensland, Northern Territory and Western Australia north of 16°S (Fig. 14).

Discussion

The single patellar spine on the male pedipalp and the basal arch of the median apophysis identify *Leviana* gen. nov. as member of the informal backobourkiine clade, although the most recent multigene molecular analyses on world-wide Araneidae did not support this placement (Scharff et al. 2020). In that analysis, *Leviana* gen. nov. (as "NGEN03") grouped with *Dolophones* and *Cyclosa* as sister group to the Australasian spiny orb-weavers ('gasteracanthines') albeit without statistical support. However, that analysis (Scharff et al. 2020) suffered from low nucleotide data density intended to solve an overwhelming taxon sampling, and thus its topologies should be interpreted as preliminary. Genomic-scale analyses of Araneidae had previously supported the placement of *Leviana* gen. nov. (represented by *L. dimidiata* comb. nov.), *Dolophones* and *Cyclosa* as sister groups to backobourkiine species (Kallal et al. 2018), although that study only used single representatives for each genus and only included two other backobourkiine terminals (*Hortophora* and *Plebs*). In contrast, Scharf et al.'s (2020) study included 13 terminals representing at least ten putative backobourkiine genera. More comprehensive analyses, possibly also including more molecular markers, key morphological characters and even more taxa, are required to resolve the phylogenetic relationships of *Leviana* gen. nov. and the backobourkiines as a whole. This initially requires further taxonomic studies at the genus level, for example the speciose backobourkiine genera *Acroaspis* and *Carepalxis* have not been treated taxonomically in detail since their original descriptions and a selection of representative species for such an analysis is currently not possible. However, our taxonomic study suggests that Scharff et al.'s (2020) clade consisting of *Leviana* gen. nov., *Cyclosa* and *Dolophones* is more likely backobourkiine, based on the presence of one of the putative synapomorphies of the clade in all genera, the basal arch of the median apophysis in the male pedipalp, or sister to the backobourkiines rather than sister to gasteracanthines with very different somatic and genitalic morphology.

The basal arch of the median apophysis in the male pedipalp is considered one of the synapomorphies of the backobourkiines. In *Leviana* gen. nov. this arch has an internal spine-like protrusion, one of the defining characters of the genus. The role of this spine is not known but it is perceivable that it provides some mechanical control during copulation. Assuming the median apophysis arch provides a joint with the radix that extends during copulation, the spine may provide a better connection or some resistance to limit that extension. Similarly, small tubercles are present inside the arch in the backobourkiine genus *Salsa* (Framenau and Castanheira 2022), but also in *Dolophones* (N. Scharff pers. comm. to VWF). The arch of the median apophysis is also modified in *Backobourkia*, where it carries an apically directed outer long flange (Framenau et al. 2010). This structure is likely to have a very different mechanical role compared

to internal tubercles or spines. Only detailed studies imaging male and female genitalia during copulation will be able to solve question in relation to the mechanical role of the median apophysis arch and its modifications.

In museum collections, *Leviana* gen. nov. species have sometimes been identified as *Phonognatha*. *Phonognatha* is an atypical araneid (Kuntner et al. 2008; Kallal and Hormiga 2018), possibly better classified as phonognathid (Kuntner et al. 2019), which builds orb webs with leaf retreats. However, in addition to a distinct non-araneine morphology (Rainbow 1897)), *Phonognatha* web architecture differs from *Leviana* gen. nov. and in certain elements resembles nephilids in retaining the non-sticky (also termed auxiliary or temporary) spiral in finished web (Hormiga et al. 1995; Kuntner et al. 2008). *Phonognatha* webs also contain three-dimensional additional threads above the orb, secondary radii that originate distally from the hub (Kuntner et al. 2008) and the leaf retreat in *Phonognatha* is at the hub, not at the top in the web periphery. The origin of leaf retreats is clearly not homologous in phonognathids/phonognathines (*Phonognatha*, *Artifex*, *Deliochus*) and in *Leviana* gen. nov.

All of the revised five species of *Leviana* gen. nov. are known from both sexes and we report their detailed size variation. These data imply that *Leviana* gen. nov. is only moderately sexually size dimorphic with female to male size ratios between 1.3 (*L. minima*) and 1.7 (*L. cincinnata*). These values do not approach the arbitrarily set threshold of *extreme* sexual size dimorphism at 2.0 known to have evolved in several other araneid clades (Kuntner and Coddington 2020). However, if the future tests confirm that the phylogenetic position of backobourkiine genera is relevant for gasteracanthines–a spider clade well known for extremely sexually dimorphic genera–, the here reported size data may be relevant for reconstructions of sex specific size evolution in araneids (e.g., Cheng and Kuntner 2014; Yu et al. 2022) and other orb-weavers (Kuntner et al. 2019), which can inform on the bigger picture of the patterns and causes of the evolution of sexual size dimorphism in spiders (Kuntner and Elgar 2014; Kuntner and Cheng 2016; Kuntner and Coddington 2020).

Leviana gen. nov. is currently only known from Australia, supporting the country as biogeographic origin of all backobourkiines. The potential inclusion of *Cyclosa* in the backobourkiines raises some interesting biogeographical questions. All backobourkiines sensu Scharff et al. (2020), but also *Leviana* gen. nov. and *Dolophones*, appear to be of Australian origin with few species found in neighbouring islands such as Papua New Guinea, New Caledonia and New Zealand – *Plebs* being distributed into South-East Asia and India being the most widespread. In contrast, *Cyclosa* has an almost cosmopolitan global distribution (World Spider Catalog 2022). This presents at least two intriguing biogeographic hypotheses, either the backobourkiines being derived from *Cyclosa*-like ancestors, or *Cyclosa* being of Australian origin with probably the most extensive Australian-born radiation at least in spiders.

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